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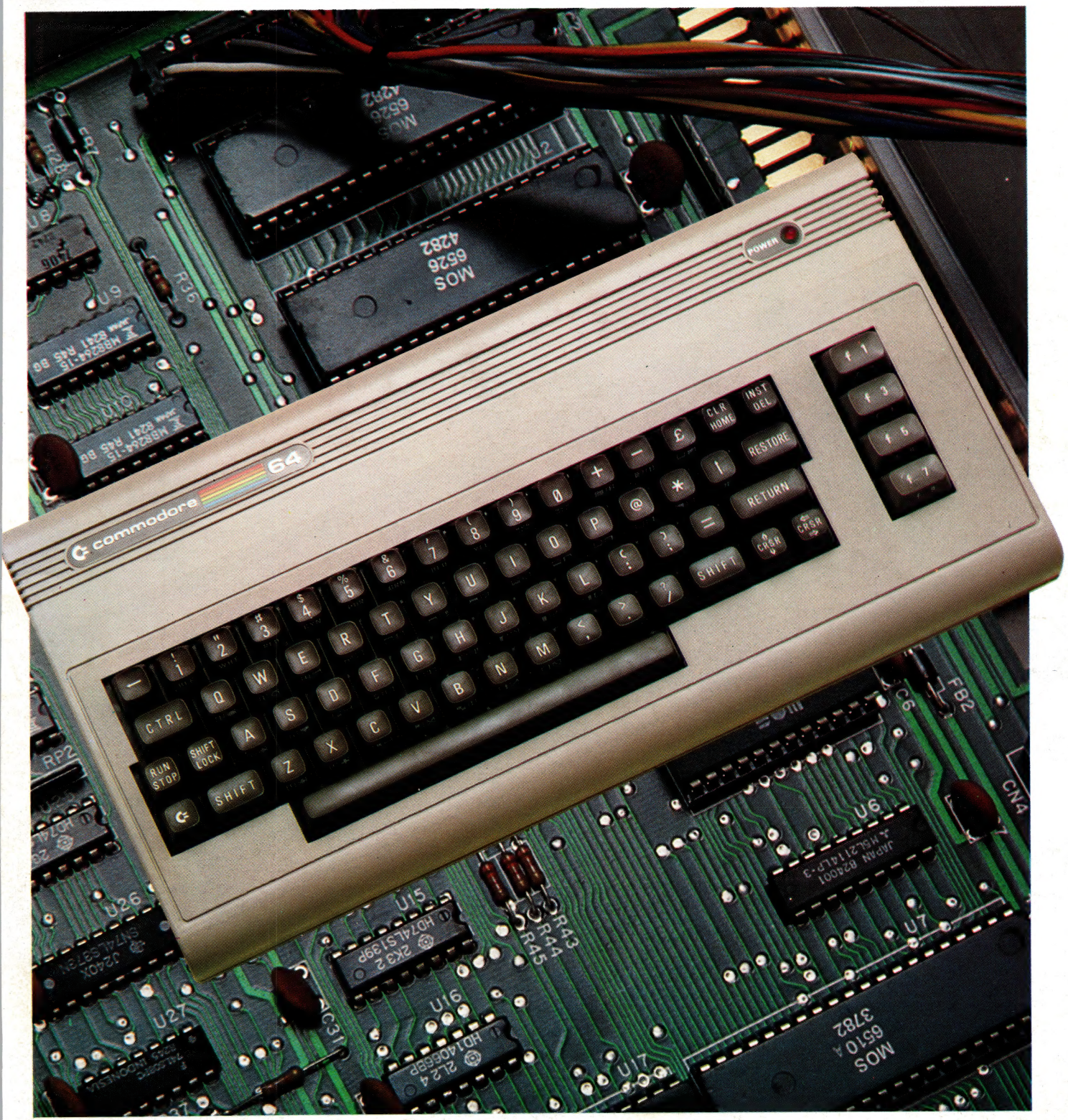
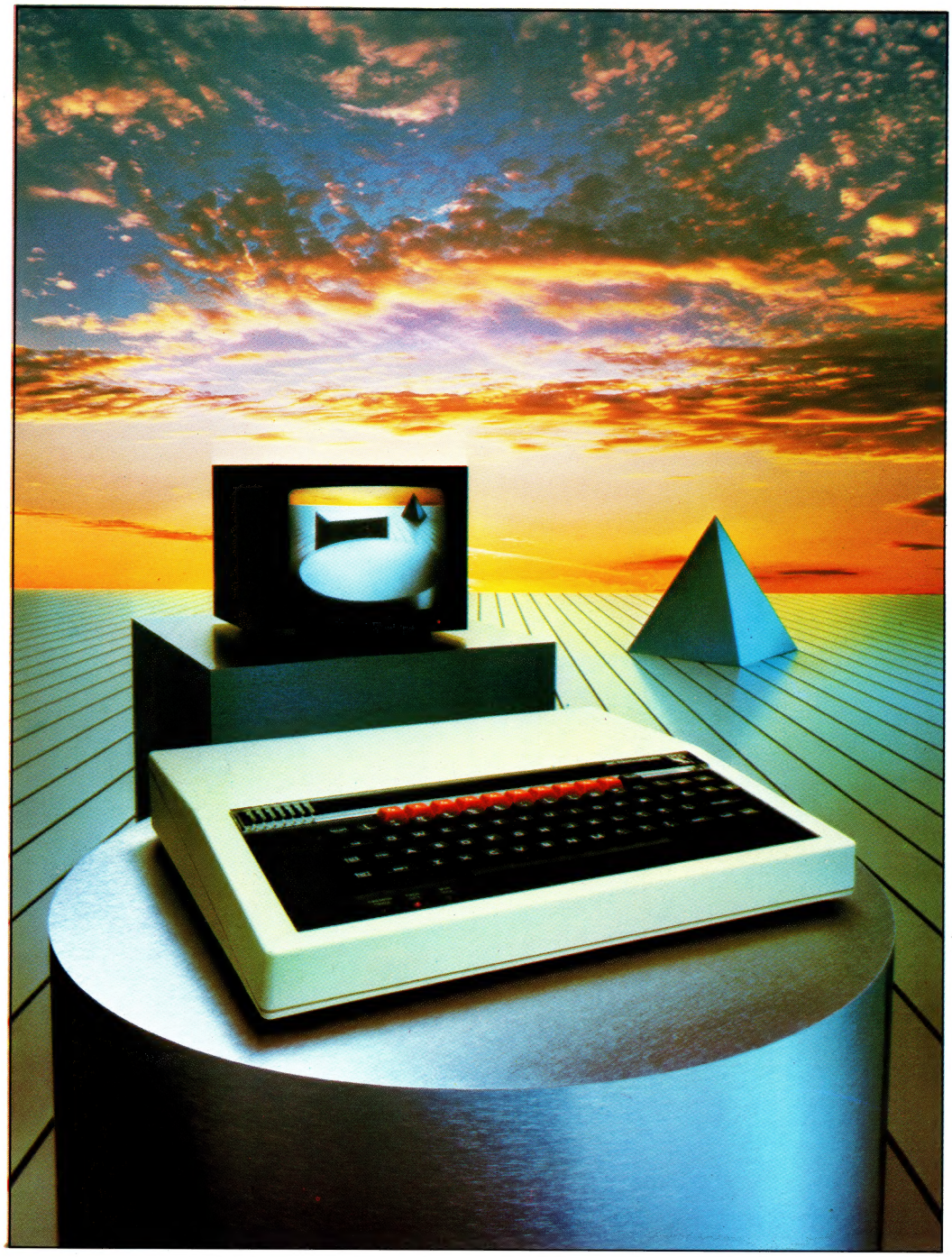


COMMODORE 64 EXPOSED



BBC Microcomputer now Starring on National Television in the BBC Computer Programme

The BBC Microcomputer is at the heart of a massive computer education project: The BBC Computer Programme, starting on Australian National Television now.

This complete computer literacy programme includes two series of television programmes for students and novices on the use and applications of computers.

The first series commences on ABC Television in May/June (September in SA) at mid-morning, classroom viewing times.

The BBC Microcomputer, designed and used extensively in UK schools computer education, can genuinely claim to satisfy the needs of novice and expert alike. It is a fast, powerful system which can synthesise music and speech. Its high resolution colour graphics provide a 'picture' of exceptional quality.

The BBC Microcomputer has been approved for use in Australian Schools by the Education Departments of WA, SA and Tasmania.
(Other Australian State decisions on approved computers for schools are pending.)

A wide range of games and educational software is available.

The computer can connect directly to cassette recorder, domestic TV set, video monitor, disk drives, printer and paddles. Its Econet network system allows numerous machines to share the use of expensive peripherals.

BASIC is standard. Plug-in ROM options allow instant access to high level languages and W.P. software.

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DEALER ENQUIRIES WELCOME

inside

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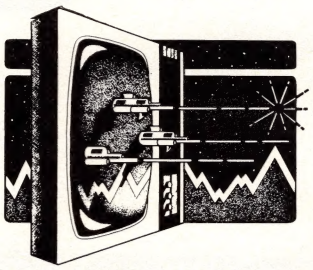
REGULARS



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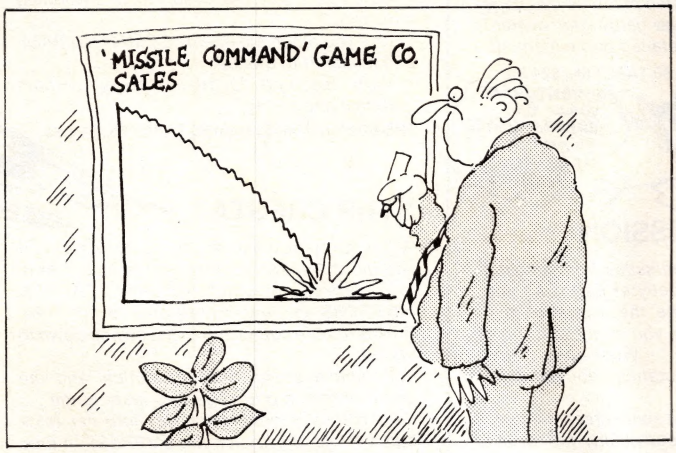

COSMIC

And now from FANTASTIC SOFTWARE!

PANIK

An arcade style game of a facinating future world with animated graphics and VOICE. Mzors have invaded earth and you are trapped on one of their building sites! Their leaders are very difficult to destroy and capable of creating more Mzor warriors at will. Your only weapons are your energy pistol, short range teleporter pack and courage.

A totally unique presentation from Cosmic Software. A MUST!

TRS-80 Model I/III System 80 TAPE 16K, $24.95.

ALIEN TAXI

Your goal is to pick up and deliver passenges to an underground resort hotel. There is a fare at each of the 12 taxi stands on the first level and if you complete that level there are 12 more on the second level. This is a very skilled game and will take a long time to master.

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DEVIL'S TOWER

Aliens have returned to the far side of Devil's Tower. You are the last line of defense to stop them from taking over the planet. They move in waves of 5 attackers with their robot scouts attacking you from the mountain, their war machines from the other side of the valley and their protector ships putting up force fields to protect them. Only your skill and fast reflexes can save the planet.

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DESERT PERIL

Your cities have been infected by a deadly virus from the planetary war with the Zagons. Your people's only chance to survive is for you to cross the Great Desert and clear a path for your people to follow. But there are many dangers. The Zagons have mined the desert and have put killer satellites, drone bomber balloons, and flying dragons along the whole trail. The future of your planet's race depends on your skill and daring.

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MORGOTH

Prepare yourself for medieval adventure in MORGOTH. Now you are pitted against fireballs, giant spiders, ghosts and ghouls with only your bow and arrows for protection. Can you do battle in the underground caverns, ancient castle or the mirky forest? Find our! Like RALLY RACER, your character is always at the centre of the screen. Morgoth features fantastic sound, a fantastic challenge and an entire moving forest!

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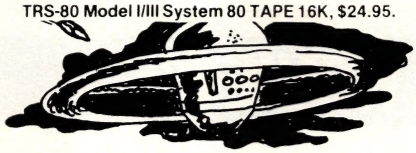
OUTLAND

As defender of Colony 7 you must beat back the lethal attacks of the Xenos empire! Beware of Star Raiders, Advisors, Scoutships, Star Destroyers and the deadly flagship. Avoid plasma bolts and laser beams in this super smooth machine language arcade game with sound. The detailed animated graphic's MUST be seen!

TRS-80 Model I/III System 80 TAPE 16K, $24.95.



BOSKONE ALERT

The ULTIMATE experience in space combat. Battle "intelligent" escort fighters, drone kill pods, and attempt to destroy the 9 Deathstars. Complete with over 100 screens of space "map" to explore and a scanner to guide your craft with.

Move 8 directionally (all terrain scrolls 8 directionally) and fight in the time-space twisted Vortex field or the moving asteroid belt! Fast moving animated machine language action beyond any arcade game ever written! With sound! Includes detailed battle manual!

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DOOMSDAY MISSION

Four thermo-nuclear missiles from a space station are pointing directly at Earth! As you beam aboard to examine the mysteries disappearance of the crew, you might find more than you bargained for . . . What lurks in the dark recesses of the station, do you dare discover it?

Doomsday Mission is a split-screen machine language adventure, whose quality we haven't seen since Scott Adams.

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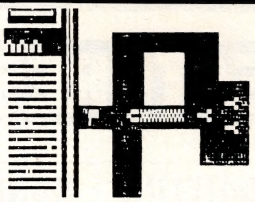

RALLY RACER

Beware! Mad Morgan, Crazy Harry and his hoodlums are on the prowl in a fantastic (32 screens!) of maze trying to track you down. Is your super charger fast enough! Your car remains in the centre of the screen while objects move around it! Your fuel is limited and you have to knock down 10 flags, but don't dispair. A grid scanner to your right indicates the position of your cars and your foes!

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STELLAR WARP

Only you can save the universe!

As your craft hurtles through space its attacked by RAZER BLADES, PODS, SPANKERS and SOLAROIDS! As every second ticks by they become more powerful. As your shield blackens you hit STELLAR WARP, now glowing with indestructible energy all space and time contorts allowing you to ram them while in the safety of hyperspace.

Super smooth animated graphics and talking sound effects combine to bring you fantastic action!

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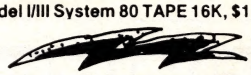

DEFENCE PENETRATOR

Can you place strategically placed missile bases or will they SCRAMBLE our system?

Now as pilot of the Z-80 Annihilator your mission is to infiltrate enemy territory carrying deadly QUAKER 5000 space-to-surface super bombs and your own crafts high high output intercept to destroy torpedoes.

Enemy defences will try to eliminate you with auto-launch ballistic missiles, Skyhawk Doomsmaster Gunships and carefully stationed ground artillery installations. Beware of rugged surface terrain, your diminishing fuel supply and meteor storms!

Can you cross the 5000 km of swooping scenarios?

Can you reach the enemy COMMAND BASE and smash it to atoms?

With machine language super smooth graphics and sound!

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STAR CRESTA

Will you place your deadly laserlances and energy absorbent shields against the relentless strikes of the fearsome FALCON FIGHTERS. Or will you fall prey to the FIREBIRDS, whose contorting forms swoop down to strike!

Your shield energy reaches critical and the great mothership lurches into laser range . . . Your cannon's grind their way into her thick hull, but can they reach the EMPRESS in time and OBLITERATE her to atoms!

TRS-80 Model I/III System 80 TAPE 16K, $19.95.

FTWARE

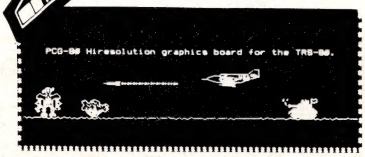
FOR THE TRS-80 AND THE SYSTEM 80.

Hi-Res Information

THE PCG80

At last, the ultimate hi-resolution modification for the TRS80 Model I & III & SYSTEM 80, has been developed. It rovides 256 programmable characters as well as the ability to emulate a 384 x 192 dot addressable screen.

The TRS80 owner can now enter computer graphics at a very sophisticated level. The PCG80 provides hardware apabilities of graphics systems costing hundreds of dollars more. You as an owner can now plot any mathematical unction, display arcs, circles, lines, waves. At the same time you can design and display custom characters ranging om 72 pixels to a massive 18432 pixels. You can mix graphics and alpha-numerics anywhere on the screen.



FEATURES

- The backup is expert. Ask your dealer.
- No conflict with existing hardware. There is no trade off in performance. you do not lose any existing functions. o user memory is affected. The PCG80 is totally user transparent, only active under software.
- As a bonus you get lowercase with full length descenders as part of the mod. That alone must be worth $50!
- It's rapidly becoming the most popular mod to the 80 based machines. Hence the software backup will be normous.
- There is a large library of software available now! It includes both utility software and games. Disk and tape sers are supported.
- It's easy to program, no sophisticated programming skills are needed to get it to work. It comes fully ocumented with both the beginner and expert programmer catered for. You can program in hi-res within 20 minutes of nstallation. Convert existing software to hi-res in 60 minutes!

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Colour HI-RES graphics, does not require extended BASIC.

Joysticks.

TRS-80 Colour Computer 16K TAPE, $29.95.

COSMIC INVADERS

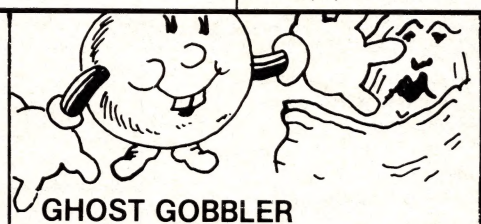
The best invader type game available. Complete with 16 skill levels, dynamite sound and 4 colour HI-RES graphics. Can you dodge the bombs long enough to blast the alien gunship and invaders. Extended BASIC not required.

TRS-80 Colour Computer 16K TAPE, $29.95.

GALAX ATTACK

If you like Space Invaders you'll love Galax Attack! Alien fighters leave formation to attack your ground base and you must fight them off! Exciting fast action with super sound and HI-RES graphics. Extended BASIC not required. Joysticks required.

TRS-80 Colour Computer 16K TAPE, $29.95.



GHOST GOBBLER

An exciting version of the PAC-MAN game with power dots, 8 bonus shapes, super sound and 16 skill levels. Hours and hours of challenging fun. Extended BASIC not required. Joysticks.

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APC reports on the latest news from the world micro scene

IBM opens the door

People are saying quite unkind things about IBM and its operating system, essentially trying to suggest that IBM is gradually perverting it to stop other people running their software.

It may happen one day, but don't believe it yet — there is no sign of it, whatever IBM's rivals may say.

All the signs so far are that IBM really is keeping the Personal Computer "open" by publishing all the details of software and hardware. Possibly the most telling indication is the announcement of a "hard" disk option and a bigger "XT" version of the PC.

Inside the announcement of a $7892 system (a minimum box with 128k bytes, a single 360k byte floppy, a 10 megabyte hard disk and keyboard, but no monitor) is the encouraging extra announcement of a program transfer utility.

This does the very simple job of taking your programs from floppy disk and putting them on hard disk. You may think it strange that one would comment on so obvious a necessity — wait till you try getting Visicalc on to an Apple hard disk.

The announcement holds nothing astounding, even though there is a new version of PC-DOS (IBM's version of MS-DOS) because IBM is under no price pressure (yet) in Australia.

The other new things were the use of bigger memory chips — you can put more memory actually inside the IBM box as a result — and an adaptor to connect the system to remote computers or devices. And, of course, the hard disk itself.

The facts may be simple: few people will believe it, even so. IBM has a long-nurtured reputation for deviousness, totally deserved, and this has led people to look for the worm in the apple even before the flower has been pollinated.

At the moment, the worm is said to be the operating system. IBM has "very deliberately" (accoding to one indignant contact inside Compaq) changed PC-DOS to prevent imitation IBMs from running software.

To prove this, my contact quoted a report in *APC* which featured an interview with Bill Gates, head of Microsoft. Microsoft wrote both PC-DOS and MS-DOS, and Gates was explaining the similarities.

According to the man at Compaq, the differences revealed by Gates were enormous. According to the man who interviewed Gates, he said nothing that could possibly be interpreted that way. According to other imitators, depending on their success in implementing their own versions of MS-DOS, or depending on the point they are trying to make, both points of view are correct.

What it boils down to is this. There are people who have produced machines which are sufficiently similar to the IBM that they can be sold on that similarity.

Some of those people have also "improved" both on the IBM hardware and on the MS-DOS software. Then, to show how clever they are, they have announced both total compatibility, and the improvement.

Then they load IBM approved software, and find that only 80% of it will run. Surprise, surprise. But guess whose fault it is!

Guy Kewney

US market worth $8bn by 1987

The USA software market is expected to reach a staggering value of $8 billion in four years time according to a report by Future Computing, the Dallas market research firm which specialises in the personal computer industry.

Future's report, called *Personal Computer Software Market Analysis*, estimates the software market was worth $900 million last year and forecasts that games and domestic software will take the lion's share of the market and will be the largest and most competitive sector.

"Business software, on the other hand, will grow from $180 million to more than $1 billion in 1987. But as it is normally a one-time purchase it grows as the market grows. Educational software is in its infancy and will grow from a $60 million base in 1982 to over $900 million in 1987. Two-thirds of educational software will sell to the home." says Future's president Portia Isaacson.

"Dramatic changes will occur in the market place within the next few years. Right now it is still in its formative stage and a good time to enter if companies do so carefully."

According to Future, Radio Shack was the biggest software publisher last year with sales worth more than $60 million. Radio Shack was followed by Apple and VisiCorp (around $38 million), MicroPro ($31 million), Atari, IBM and Texas Instruments all pegging level with around $26 million, Digital Research ($22 million), Commodore ($15 million), and Peachtree with $10 million.

Texas Instruments put on the most proportionate gain since 1981.

The full report is available from Future at a cost of $1,195 from: Publication Sales, Future Computing, 900 Canyon Creek Center, Richardson, Texas 75080.

VisiCorp joins forces with Informatics

VisiCorp and mainframe software giant Informatics have joined forces to produce data exchange links between personal computers and large IBM machines.

A similar scheme has been announced by Peachtree and its parent, Management Science America, but no products have appeared yet.

The VisiCorp/Informatics deal will initially produce two products, *VisiAnswer* from the micro firm to run on the IBM PC, and *Answer/DB* from Informatics. These form an 'intelligent link between the two computer systems, and will allow PC users to extract any data they like from mainframe databases.

This data is stored on the micro in VisiCorp's standard DIF format, and can be used as raw material for *Visicalc* or any other *Visi* products.

According to Informatics chairman Walter Bauer, the products will give "decentralised users what they have wanted for a long time — personal availability of data from mainframe databases. And VisiCorp Chairman Dan Fylstra believes that the proliferation of personal computers in large companies has "helped create a growing data management crisis.

"Our customers expect us to be part of the solution to this emerging crisis," says Fylstra.

VisiCorp already has a package *VisiTerm*, that turns an Apple II into a mainframe terminal. But *VisiAnswer* and *Answer/DB* go beyond that by taking care of the mainframe signing-on procedures and shielding the user from the database query language as well as formatting the mainframe output for personal computer use.

Answer/DB can provide access to a variety of mainframe database systems, including IBM's own *IMS* and *DL/I* and Cullinane's *IDMS*. It will also work with files accessed by *VSAM*, *ISAM*, and other standard IBM access methods. The first version will run under the *IMS/DC* telecommunications monitor, with *CICSD*, *CMS*, and *TSO* versions to come.

The IBM PC is the only micro supported by *VisiAnswer*, and future versions will work

under the new mouse-driven *VisiOn* on that machine.

Communications between the two packages will use a proprietary protocol at first, but IBM bisynchronous and SNA protocols will follow.

The first public showing of the package will be at the National Computer Conference, held in Anaheim, California, in the middle of May. You should start saving now; the US price of a typical configuration consisting of one copy of *Answer/DB* for the mainframe and 50 *Vision-Answers* for the micros is slated at $45,000.

Getting together

An association of computer retailers was formed on March 11 (during the *APC* Show). Its members felt that "there should be some positive manner of indicating to the public those retail dealers who are professional and capable and can help and advise customers about which system that is most suitable for their home, business or educational needs."

It is intended that purchasers can distinguish members of the Australian Computer Retailers Association by its logo which will be displayed by computer retailers. The Association will be applying for membership of the Australian Retailers Association.

For further information, contact Bernhard Kirschner on (02) 235 2162 or write to the Australian Computer Retailers Association, GPO Box 268, Sydney 2001.

Peachtree IBM link

The general manager of Peachtree Software (Australia), Mr Robert Fisher, has confirmed details of marketing agreements reached with IBM for Peachtree's micro based software products, following the worldwide launch of the new IBM XT personal computer.

As Mr Fisher explains, such agreements presently vary from country-to-country, reflecting the very rigorous product testing and support criteria IBM demand of any externally sourced software.

Additionally, Mr Fisher said that the variety of agreements that currently exist in various countries reflect the policy of both IBM and Peachtree to ensure that all applications systems are totally attuned to local requirements and conditions prior to market introduction.

"As a result of this, IBM has announced in North America that it will market directly under its own logo, Peachtree developed software covering word processing, general ledger, accounts receivable, accounts payable, inventory control and payroll

SOME COMPUTERS ARE BETTER THAN OTHERS

COMPUTER COMPARISON CHART

	SPECTRAVIDEO SV-318	APPLE II PLUS	ATARI 800	COMMODORE 64	COMMODORE VIC 20	TANDY
BASE PRICE	**$499**	**$2100**	**$1100**	**$699**	**$299**	**$549**
COMPUTING POWER FEATURES						
BUILT-IN ROM	32K	12K	10K	20K	20K	8K
EXPANDABLE TO	96K	N/A	42K	N/A	N/A	14K
BUILT-IN EXTENDED MICROSOFT BASIC	YES	YES	ADDITIONAL COST	NO	NO	NO
BUILT-IN RAM	32K*	48K	16K	64K	5K	4K
EXPANDABLE TO	144K**	64K	48K	N/A	32K	32K
KEYBOARD FEATURES						
NUMBER OF KEYS	71	51	61	66	66	53
USER DEFINE FUNCTIONS	10	N/A	4	8	8	N/A
SPECIAL WORD PROCESSING	YES	NO	NO	NO	NO	NO
GENERATED GRAPHICS (FROM KEYBOARD)	YES	NO	YES	YES	YES	YES
UPPER/LOWER CASE	YES	UPPER ONLY	YES	YES	YES	UPPER ONLY
GAME/AUDIO FEATURES						
SEPARATE CARTRIDGE SLOTS	YES	NO	YES	NO	NO	NO
BUILT-IN JOYSTICK	YES	NO	NO	NO	YES	NO
COLORS	16	15	128	16	16	8
RESOLUTION (PIXELS)	256 x 192	280 x 160	320 x 192	320 x 200	196 x 184	192 x 256
SPRITES	32	N/A	4	8	8	N/A
SOUND CHANNELS	3	1	4	3	3	1
OCTAVES PER CHANNEL	8	4	4	9	9	3
A.D.S.R. ENVELOPE	YES	NO	NO	YES	YES	NO
PERIPHERAL SPECIFICATIONS						
CASSETTE	2 CHANNEL	1 CHANNEL	2 CHANNEL	1 CHANNEL	1 CHANNEL	1 CHANNEL
AUDIO IO	YES	NO	YES	NO	NO	NO
BUILT-IN MIC	YES	NO	NO	NO	NO	NO
DISK DRIVE CAPACITY	256K	143K	96K	170K	190K	156K
(LOW PROFILE)	YES	NO	NO	NO	NO	NO
CP/M COMPATIBILITY (80 column programs)						
CP/M* 2.2	YES	NO***	NO	NO****	NO	NO
CP/M* 3.0	YES	NO	NO	NO	NO	NO

* 16K user address able plus 16K graphic support
** 128K user address able plus 16K graphic support
*** Apple II can accept modified 40 or 80 column CP/M
**** Commodore 64 accepts 40 column CP/M

Microsoft is a registered trademark of Microsoft Corporation
CP/M is a trademark of Digital Research, Inc.

OURS IS MUCH BETTER

When you start comparing Spectravideo's SV-318 to other personal computers, you'll find there really is no comparison. The SV-318 is the only logical choice, because it does more than some computers costing 4 times as much. And its abilities simply embarrass other computers in this price range.

The SV-318 isn't just more capable. It's much more capable. No other computer at even twice the price comes near its 32K ROM expandable to 96K. Or to its 32K RAM expandable to 144K. And no other computer has a built-in joystick/cursor control—an immeasurably useful feature when it comes to playing your favorite video game. Further, the SV-318 has, as its resident "language" Extended Microsoft Basic, the industry standard. It even has built-in CP/M (standard 80-column program), so you can immediately utilize over 10,000 existing software programs.

The SV-318 isn't just more expandable. It's much more expandable. Unlike many other so-called computer systems, all our important peripherals are available at once. That means you can get almost full usage out of your SV-318 from the day you buy it. With the Super Expander, Data Cassette, Floppy Disk Drive, Dot Matrix Printer, Graphic Tablet and SV-800 Series Expansion Cartridges, there's almost no end to the work you can do. Or to the fun you can have. The SV-318 is well designed to interface with new options as they become available, too. All this adds up to a computer you'll grow into, not out of.

The SV-318 is not only eminently affordable, it's the first real bargain of the computer age! Besides business application, home budgeting, word processing, programming and self-teaching, the SV-318 is the best entertainment value in town. Not only can you use it with your TV or color monitor to play hundreds of different video games,

FOR UNDER $500

with the optional SV-105 Graphic Tablet you can draw pictures, graphs, charts and other visual images on your TV screen. Considering what you get for what little you pay, the SV-318 is once again the only logical choice.

Whether you're investing in your first computer, or are already well versed in today's most important machine, you'll find that the SV-318 is the only logical choice for you.

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applications," Mr Fisher said.

"In Europe the agreement spans certain accounting applications, while in Australia the recent local IBM announcement refers only to the Peachtree word processing package Peachtext."

Peachtext is described by Mr Fisher as the first full featured word processing software product under the IBM label which, while remaining very easy-to-use, contains extensive facilities for the IBM Personal Computer user.

Similar standard Peachtree word processing software will also be available to Australian users of Apple, DEC, Xerox, Sirius, ICL and Altos personal computer hardware in a similar timeframe according to Mr Fisher.

Many of these agreements, additionally include the evaluation of Peachtree's accounting packages Mr Fisher said, which are currently being converted for the Australian and New Zealand marketplace.

HES here

Imagineering has announced that it is now exclusively manufacturing and distributing the HES Software range. HES writes software exclusively for Commodore computers. The backbone of their products is HES Writer, Turtle Graphics (for novices learning programming concepts), Forth (see previous issues of *APC* for reviews of the language; it has also recently been made available for the Commodore 64), HES Mon and Synthesound.

As Imagineering distribute their products very widely, you should be able to buy HES software from most Commodore outlets.

Authors wanted

Melbourne-born publisher and author of over 25 books on microcomputers, Tim Hartnell, is currently looking for new authors. He says his company, *Interface Publications,* which has offices in New York, London and Melbourne, has sold half a million books since its founding in March, 1981.

Hartnell says he'd like to hear from programmers who can assist with the completion of books already in progess, and from microcomputer authors with completed manuscripts, or with ideas for books.

"We concentrate on books aimed at owners of specific machines," he said. "Many of our most successful books are collections of games, or instruction books which teach programming.

"We pay extremely well, and as well as getting the books published in Australia, the UK and America, we've sold translation rights to most titles in seven European languages."

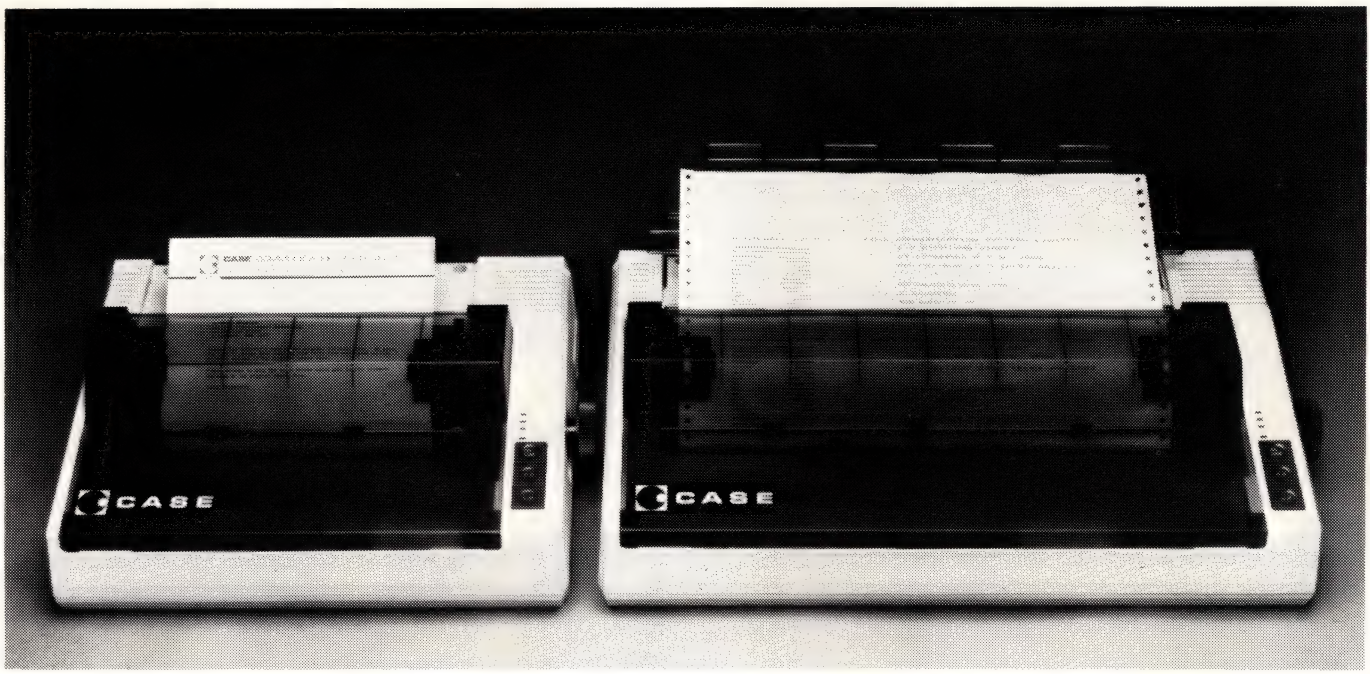
Tim says the company's youngest author is 12, and the oldest over 60, "so age is not important. What is important is access to a computer and printer, and a high standard of programming ability. If you have any ideas for microcomputer books which you think would interest *Interface Publications,* write to 62 Fulton Street, Clayton, Vic 3168. This is a mail address only.

Buyers' Guide

Imagineering has produced a Software Buyers' Guide for the Apple, IBM PC, VIC-20 and all popular CP/M based machines software.

"Our major problem within the industry is that very few of the retail stores are stocking personal computer software in any volume, and the consumer is not aware of what software is available in Australia for his

Write off 25%



CASE has released two new models in its DP Series matrix printers.

If it weren't for their price, their capabilities alone would make them remarkable machines.

But at around 25% cheaper than their nearest competitor, they deserve your closest scrutiny.

The multi-function capability of the DP series enables use in a variety of applications. Alpha numeric or graphic printing, single sheet, roll or tractor feed paper.

The DP 500 Series can even produce proportionally spaced correspondence quality print.

Utilizing a bi-directional logic seeking mechanism, the printers operate at 100 CPS, with 80 characters per line on model 510, and 136 characters per line on the wider carriage 515.

After you've compared these two machines to others on the market, you'll have to agree with us. It's an open and shut case. For CASE.

For complete details on CASE DP Series 500 printers, contact your nearest CASE office.

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specific machine," says an anonymous member of Imagineering's staff.

To combat this, Imagineering has produced the "S.B.G." offering an overview of its product range. In-depth reviews of both Visicorp and MicroPro products are included.

The S.B.G. is available from all microcomputer stores and leading book stores at $3.75.

Dot's here

The 'Dot' micro we first mentioned some time ago has finally made it to Australia. It's portable and claims to be IBM PC compatible and, although the main marketing thrust will not play heavily on this compatibility feature, it is likely that this will be an important criteria in it gaining acceptance. Naturally it's 16-bit, runs MS DOS, has a full QWERTY keyboard and there is provision for a built-in printer.

Radaro Computer Devices is distributing the machine in Australia at an end user price around $5000.

Liberal Topic

An unusual opportunity to tell an unusual group of people about micros: the American journal Topic is asking for 2,500-word articles for a special edition about computers in education. "Topic's readership consists of international liberal arts-faculty people in a variety of fields," says the request, adding: "It's readers are therefore highly sophisticated, but may not be acquainted with technical jargon."

Obviously, every paper that wants articles doesn't make a habit of writing to us, and if they did, we couldn't help — but this is so unusual; that it seems worth publishing the address of Thomas W Hart, Ph.D at Washington and Joseph Levenstein, Ph.D. at Jefferson College, Washington, Pennsylvania 15301.

Exhibitors get choosy

There is only one Comdex, and that is the exhibition in Las Vegas in the late autumn. There is another in April (26-29) which up till this year had been growing just as fast, and was just as worth attending if you had to know what was new.

This year, it had "only" 600 exhibitors in Atlanta, Georgia.

It sounds enormous, but the Spring show in every previous year has been bigger than the preceding Fall show. Last Fall, Comdex had around 1,000 exhibitors, so Interface Group will have to do a bit of drum-thumping. Either that, or cut exhibition prices. Nobody can afford all these exhibitions each year, and obviously the picking and choosing has started.

NEC's APC

Providing us with a further clue to the size of the 16-bit business market, NEC Information Systems Australia has given details of its growth in sales and shipments of its APC.

"Since January we have taken orders for over 500 units, with over 350 units already shipped. Shipments this month will be around 110 units and we anticipate orders in May and June will exceed 150 units in each month.

"We expected the APC to be very successful, but the market response has been

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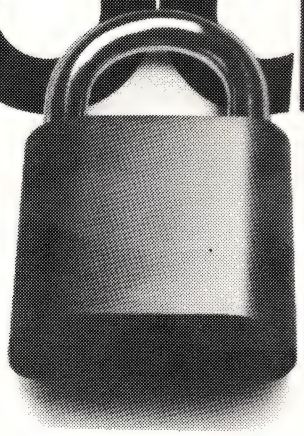

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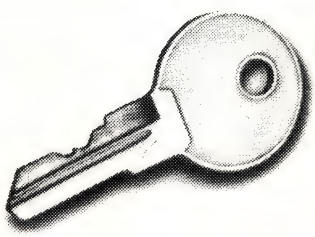

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exceptional and we believe that actual orders may well exceed our current expectations".

AUSOM challenge

The AUSOM Challenge will be conducted by the Apple Users Group of Melbourne and sponsored by Verbatim Australia. Additional support will come from Apple Users Groups in NSW, WA, SA, ACT and Tasmania.

The Apple Users Society of Melbourne (AUSOM) and Verbatim Australia are sponsoring a programming competition with cash prizes (a total of $1250 is offered). Consolation prizes are Verbatim clocks and every registered entrant will receive a Verbatim twin disk pack.

Entrants will be required to develop a totally new package. Accordingly, products available commercially, at the time of judging, will not be considered. The judges will look for originality and innovation and will consider areas such as marketability, documentation, ease of use, reliability and overall presentation.

Highly desirable features are said to include positive answers to these questions: Does this product fulfill a need and can it be modified to user requirements?; could this product be cost justified?; is the documentation adequate and provide relevant examples?; and is this a new way of approaching an existing subject?

Closing dates for the three sections of the competition are as follows:

Business Applications: 3.9.83
Games: 4.2.84
Education: 2.6.84

If you want more information and entry details etc, send a SAE to Ausom Challenge, P.O. Box 119, North Balwyn.

Apple's top man doubles his money

Despite getting a reported $2 million in his first year, Apple's new president and money are "just good friends." So says the man himself, ex-Pepsico president John Sculley.

According to the *Wall Street Journal* the incredible package put together for Sculley more than doubles the money he was due to receive as head of Pepsico's soft drinks unit.

"Apple has agreed to pay Mr Sculley a $1 million bonus when he starts, $1 million in salary and bonus the first year, and $1 million in severance pay if he leaves," said the *WSJ*. "He also gets a package of benefits, including options on 350,000 shares of Apple stock, and financial help buying a $2 million house in Woodside, California."

In exchange for this interesting deal, Sculley remained cool on the subject of his future inside Apple. His optimism, if he felt any, was carefully concealed: "Once I left the security of Pepsico and went to the other side of the country to an industry I didn't

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The new Apple management team (and their coats and ties) responsible for the marketing, distribution, sales and customer support of Apple products in Australia from May 1.

know, I knew if I wasn't successful, I'd have a tough time coming back," he told the *WSJ*.

However, he does .see the computer business where the softdrink business was 10 years ago," apparently. "It's a high-growth business and competitors are still being formed," he added.

Although there exists a similar work-hard ethic at Apple as Sculley has been used to at Pepsi, he acknowledges the atmosphere will be different. "I won't have a big fancy office like I do here (in Purchase)," he says. "They work in cubicles, and they don't wear coats and ties."

German Smalltalk

A month before Xerox was officially due to launch its Smalltalk language (the original inspiration of the Apple Lisa and the Xerox Star) an independent German software house announced a version that will run on the original Apple II.

The German firm is headed by ex-patriate American C J Macie, who is offering the software "for a minimum of 256k Apple" at a price of Dml,450, or Dml,950 for a system that allows the user to integrate new assembly code routines, with documentation.

The software is said to run on the IBM PC and the Sirius/Victor, as well as the Apple II.

Osborne goes Executive

Osborne has launched its new machine, another portable CP/M micro, in the US. It gives the company its first chance to join the IBM bandwagon.

It also provides a bigger, clearer screen, and several hardware improvements.

The new machine, called the Osborne Executive, is not expected to appear in Australia until mid September, according to Australian managing director Richard Graham.

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So, you Tandy guys, next time you walk out of the new Computer Centre in Moorabbin, take a look over your shoulder – we're right behind you. About 250 yards to be precise.

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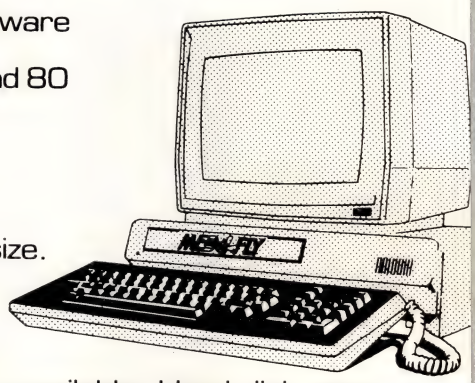

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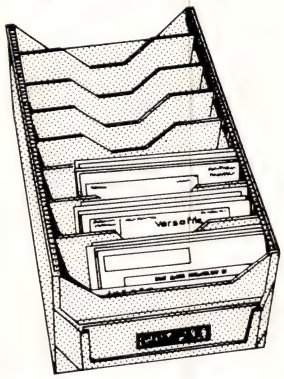

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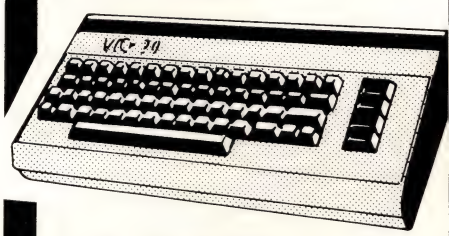

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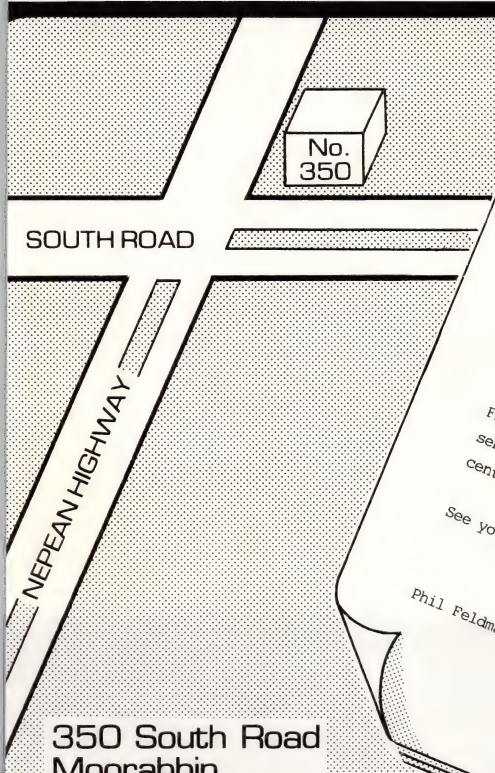

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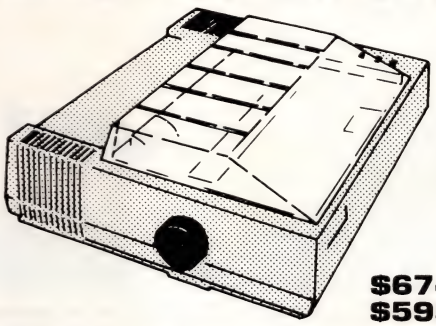

$674 inc. tax
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Apple is a registered trademark of Apple Computers Inc.

Graham told *APC* that it would appear "in limited quantities, from September, with volume shipments starting in November."

Pricing in the USA is set at $2,495 for the basic portable Executive, with the extra IBM-like processor board costing an extra $600 (taking total price to $3,195).

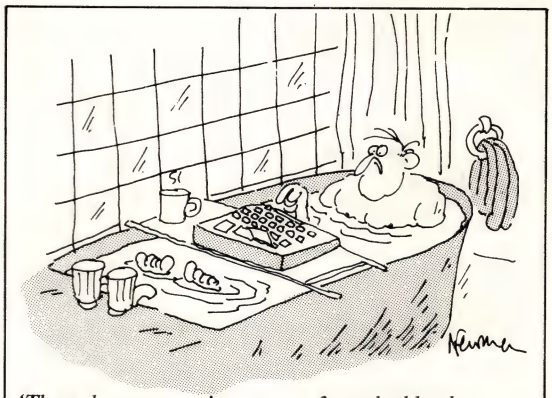
Guy Kewney writes: "I tested the Executive out on my visit to Osborne's head office last month. It will appeal to all the people who disliked the Osborne 1 for its small screen, its scrolling display, and its limited memory.

But it will severely disappoint fans of the original machine, both on specification and on price."

Hardware, first, then packaging: the operating software is upgraded from ordinary CP/M to the new CP/M Plus — which allows nicer graphics, and much more internal memory. Standard memory on the Executive starts at 128k bytes.

As before, Osborne makes the price much more attractive than it looks by bundling in a lot of user software.

This time, the package is considerably enhanced to include a proprietary "Universal Terminal Emulator", UCSD Pascal, a program generator (Personal Pearl), and several of Microsoft's programmer utilities instead of the ordinary Digital Research assemblers — for example MAC, the macroassembler that can write code for the Zilog chip, not just the 8080 instruction set, is



'These days you can't get away from the bloody things even in the bath!'

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To stay in business and succeed in business today you've got to keep moving. And with the powerful and portable Osborne 1 computer you can do just that. Take the Osborne 1 into your life - into your office, your factory, your farmhouse or your home. At $1995* it's not much of a risk - not to computerise is.

Today's world is a computer world and a tough world. You need to look at the business computer as a necessity and look for value in a business computer. The Osborne 1 has been praised in magazines like Your Computer, and Australian Personal Computer, just for the hardware you get for the price. It has a powerful 64K RAM memory; full business keyboard with alpha and numeric; two built-in floppy disk drives - now with double density, and a built-in screen - all inside a tough, portable case.

But that's not all. The Osborne 1 comes complete with five software packages included in that $1995* price. The programmes are WORDSTAR for word processing with MAILMERGE for automatic letter processing; the CP/M industry-standard operating system; SUPERCALC electronic spreadsheet for accounting and calculations; and two programming languages, CBASIC and MBASIC. It has to be Australia's best value. The Osborne 1 doesn't need a fancy environment, any desk-top will do. And it's so easy to install. Just plug it in and turn it on, and it's ready for your business.

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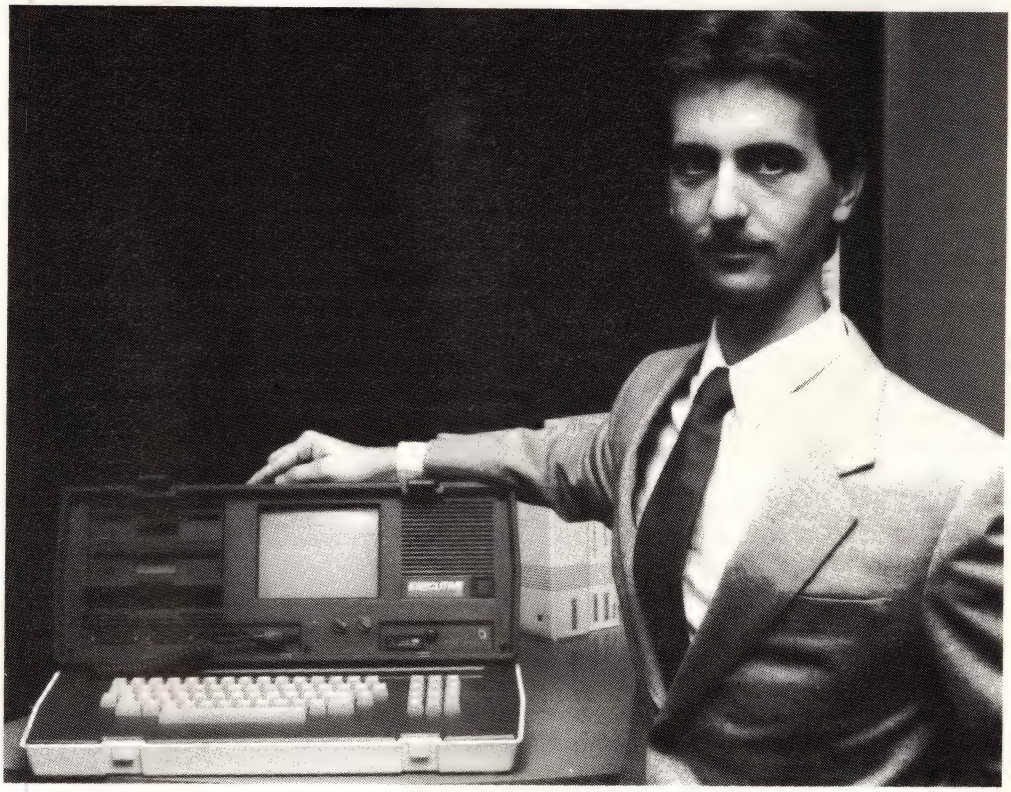
included.

Software is planned for the Executive II — the one with the IBM-like processor — will probably include something like Microsoft's Interface Manager — either that, say executives, or Visicorp's VisiOn.

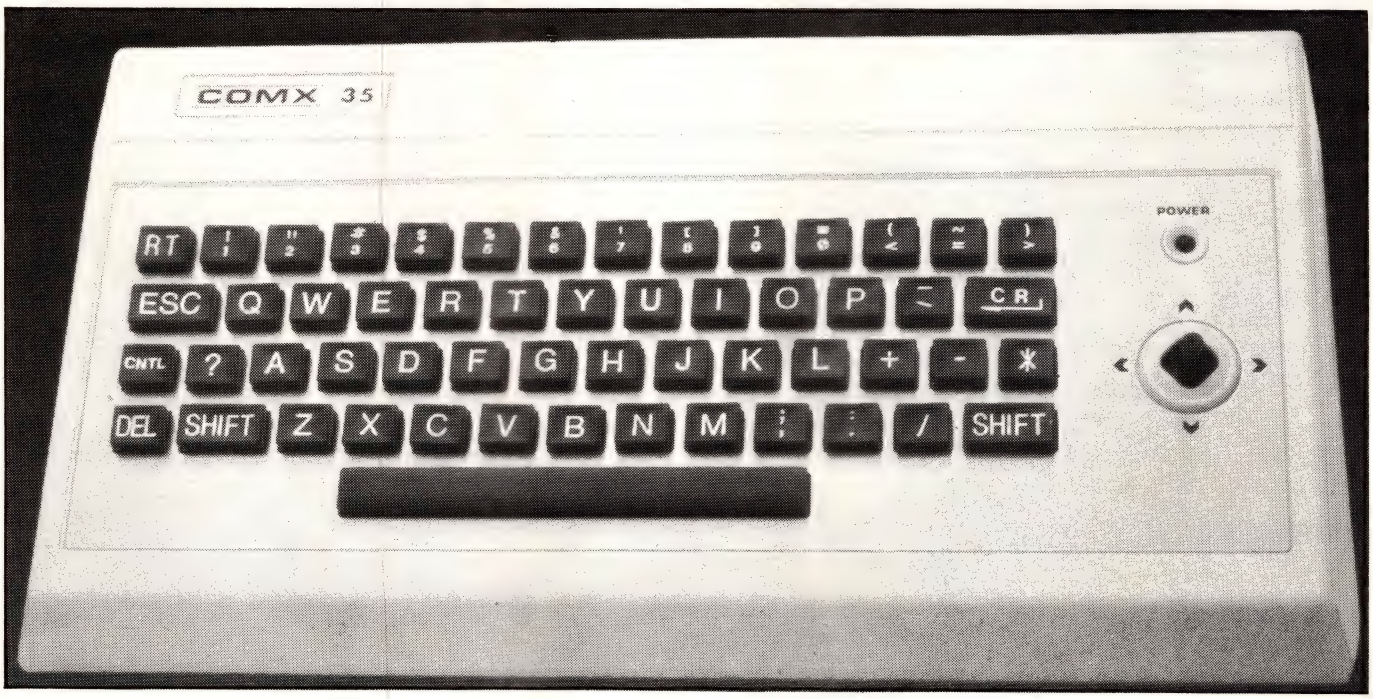
The appearance of the machine changes only at the front, with the appearance of a much larger, orange screen, with an orthodox 80 columns.

The version of WordStar supplied is the automatically scrolling version 3, which theoretically means that Osborne's original invention of a 128 column screen, viewed through a 52-column "window" has been abandoned.

New user-friendly features include automatic software frequency change on power supply.



Osborne (Australia) MD, Richard Graham, with the Executive.



Hot on the heels of Dick Smith's VZ-200 comes the Comx 35. It's more expensive than the VZ-200, selling at $299 (about the same price as Commodore's VIC-20).

We haven't had the machine long enough to evaluate it fully but a few of the basic specifications are 32k of user RAM, a 16k ROM, calculator-key style keyboard, a 24 row by 40 column screen, colour graphics, built-in joystick and 1802A cpu (whatever that is). The Basic is quite unusual in that it is an extension of ANSI Basic with features like computed GOTOs and a "semi-compile" instruction (more than just tokenising Basic keywords) which improves program execution speed.

NEWS DATELINE: HANOVER

Commodore loses faith

Tramiel: covering missing machines with gloating over big-selling Vic and 64.

The promise of "an equivalent workstation to Apple's Lisa" inside nine months proved a severe test of the micro industry's credulity about Commodore, after the disappointments of last year's Hanover announcements.

Commodore boss Jack Tramiel allowed himself the luxury of a good gloat about his company's success with the Vic20 – and indulged in obvious pride about forthcoming products including the portable Commodore 64.

But Commodore's anxious business dealers remained obviously sceptical, even though Digital Research is known to be developing a software product that could match the "equivalent workstation" llabel.

Tramiel made his presentation in the sort of expansive tone of voice which only commercial success on a grand scale can generate.

However the Commodore stand was noticeably bare of model 700 machines with integral diskettes, and news of production of these machines did not materialise during the conference. Tramiel did say that "the 700 with an add-on 8088 processor plus Concurrent CP/M-86 and MS-DOS is available today."

But this news was not verifiable with prominent software houses who would hope to develop code for such a device.

That machine was announced at Hanover last year with a promise of September 1982 delivery. And the prolonged delay has profoundly antagonised several large Commodore business system suppliers, some of whom have taken orders for the system from end-users.

Tramiel's assurances that Commodore would have "an equivalent workstation" to the Xerox Star and the Apple Lisa "for $3,000 or even $2,000, before the end of the year," therefore, were not accepted uncritically.

One possibility is that the product Tramiel referred to is actually a standard Commodore micro running a new integrated software suite currently under development at Digital Research.

This product, known internally as Monarch is reportedly far from ready for release, though privately, Digital Research executives speak of a "late summer" launch.

Some doubts were also felt about the portable 64, (first reported in *APC's* report from the January Consumer Electronics Show in Chicago).

These doubts centred on the quality of its integral Osborne-sized colour display.

It is apparently recognised that this is below the standards most users will expect, and it is also apparently intended that most users should have an add-on monitor for general use.

But at press time, *APC* had no reports of a portable version using Australian standard (PAL) outputs.

Sord working on two 32-bit systems

Sord carefully leaked the news that it was working on 32-bit systems – on just one, but quite possibly two, 32-bit designs.

The Japanese company also announced its own local area network scheme which had the merit, according to boss Shiina, of being simple (hence its name, S-Net).

And a trail joint marketing and service support operation with Mitsui was announced, for Germany only, initially.

The machines are expected to appear in May, and at the end of the year. Only guesswork is available on likely details such as "what chip" and "how much memory" – but Shiina did give a broad hint.

He said that the first machine would be "about half the power of a Digital Equipment supermini – the

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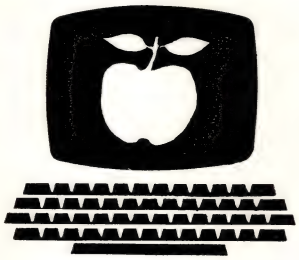

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Vax 11-780 – and about a tenth of the price." And he suggested a Unix like operating system would be available.

But sources talk of a far bigger and more powerful system also due for release this year, possibly based on a version of National Semiconductor's 32-bit 16032 family.

The network, S-Net, is available today, said Shiina, but only on Sord computers.

It uses a central control box – either for 32 systems or a bigger one for 128 systems – working through an RS232 interface, and each computer on the network has to run software to drive it.

But Sord does not propose to write this code for every other machine with an RS232. "We will help other manufacturers write software," said Shiina at the launch.

GUY KEWNEY

Shuna (right): dropping hints about 32-bit.

Apple-compatible calculator

Into a world of imitation Apples that are all at least as big as the original, the German tape recorder king, Uher, has released a 'compatible calculator'.

The machine is called the PA-2 (for pocket Apple 2) Kiwi, and it is compatible both at Applesoft and disket level, says the Uher computer subsidiary, Assman.

Priced at Dm800 for a system with 8k of memory, plus a single half-height diskette (including interface) for Dm1,000, the system is obviously not a direct rival to the Apple.

However it does allow software development "in the train or aeroplane" and once fitted with its maximum 32k of the sort of memory that uses only battery power (Cmos chips) could even

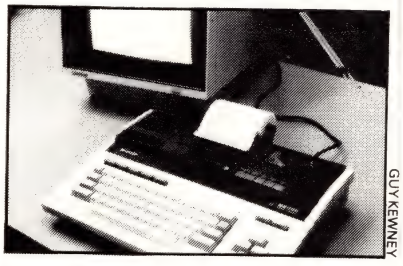
be used for text preparation.

The display is a miserable 16 character LCD one, but it does scroll to the full 40 character Apple line.

Languages available include Pascal, Pilot and Lisp as well as 'Kiwi-Soft' Basic.

And the one thing it has over the Apple is a built-in clock "including a full stop-watch facility."

September debut for Sharp's new MX700 machine



GUY KEWNEY

MZ700 – comes with printer-plotter.

Sharp showed several completely new machines, some of which even the stand staff (officially) knew nothing about.

Sharp's new home machine is the MZ700, which differs from al previous Sharp desk-tops in having no built-in screen. It does, however, include a printer-plotter with multi-coloured pens, in its Dm1,600 price.

The real interest on the Sharp stand, however, was a machine called the Z1. This micro has incredibly brilliant colour graphics that can be mixed on screen with the output of a video player.

"We have no information on this system," the stand staff lied politely.

Thermal printer for plain paper from Kyocera

The cleverest product on the Kyocera stand was not its enormous, mouse-powered IBM-compatible network micro. It was a thermal printer for plain paper.

The concept of a thermal printer normally implies special heat-sensitive paper, which is neither nice to feel, nor particularly cheap to buy. But since the print head is 'solid state' there are no moving parts like matrix needles either to wear out, or to slow the process down.

Kyocera found a way round the dilemma very elegantly. It uses a thermal ribbon.

The company is best known for its ceramics, including artifical hip joints, and its CB radios. Its first computer is a very large-scale version of the IBM PC with the substantially more powerful iAPX 186 processor chip (sometimes known as the 80186).

This central processor computer will not be sold under Kyocera's brand name, but will be supplied to other system builders.

With it, there is an 8088-based workstation with a single diskette which can link up in clusters of four or five to one of the central giants. And both the little and the big units have mouse-holes on their keyboards.

As to price, the company insisted that it wouldn't be able to control that, so it wasn't prepared to give any indication – beyond saying that, of course, to compete with IBM, the end-user price would have to be very substantially lower than IBM's.

GUY KEWNEY

Kyocera: mousehole on keyboard.

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MS-DOS II

IN SEARCH OF PERFECTION...

Peter Rodwell continues his quest for the definitive micro operating system

Microcomputer operating systems are fast becoming something of an obsession with me. The whole point of microcomputers is that they are cheap enough to allow everyone access to computing power, especially people with no previous formal computing knowledge or experience. In particular, the busy businessman can, in theory, buy a low-cost machine which will help him to become more effective and efficient in his work. All he wants to do is to take the thing out of its box, plug it in and get down to work.

In the present state of things, he can't do this. When he switches on the computer, the first thing he comes across is the operating system — and that's where the trouble starts. To date the only operating system I have seen which even approaches a reasonable degree of user-friendliness is that of Apple's new Lisa. It's not perfect but it has gone much further along that road than any others and shows that Apple at least has a reasonable conception of the requirements of the average business user. Of course the whole effect is quite ruined by its ludicrously high price — about twice what it should be and high enough to prevent it taking off at the mass-market level which the microcomputer industry is all about.

Meanwhile the rest of the world has to make do with what it's given and for many business users this has usually meant CP/M and its derivatives. But the rise of the 16-bit micro has opened the door to new operating systems. These processors have both the power and the memory capacity to use more sophisticated operating systems — ones which are designed to make things easy for the user rather than for the programmer who wrote them. So far, the two major operating systems to emerge for 16-bit computers have been CP/M-86 from Digital Research and MS-DOS from Microsoft. I reviewed and compared these two operating systems in last November's *APC*. At that time both systems were in their first versions and many facilities which had been promised were not available, such as the 'help' facility for CP/M-86. Both operating systems bore depressing similarities to the original CP/M (now called CP/M-80) and therefore didn't really represent much of an advance towards an operating system fit to be placed before the raw end user.

Recently, however, I was shown a pre-release version of MS-DOS 2, Microsoft's newly upgraded version of its operating system. And a rather strange mix it turns out to be: like the legendary curate's egg, it has some good (ie, user-friendly) parts but the whole system has been steered in what I consider to be a rather dubious direction.

When MS-DOS first appeared it was widely rumoured that, although it looked and behaved very much like CP/M, it was internally a Unix-like system. Unix is a minicomputer operating system designed to make life easier for the programmer. As a software development environment it's very good and has masses of sophisticated features. But it was designed to be used by computer professionals and therefore requires that its users be familiar with various computing concepts and terms. This in turn means that it is quite unsuitable for the computer-naive user who has neither the time nor the inclination to get his head round computer science. I was therefore rather disappointed to find that MS-DOS 2 had been given a much more Unix-like feel to it; when I compared CP/M-86 and MS-DOS previously, I felt that Microsoft's product was definitely the better of the two as regards its user image. Certainly Digital Research appeared not to have made any efforts at all in that direction. The new MS-DOS retains all the features of Version 1 but a whole host of new facilities have been added. It is still better than CP/M-86 as regards its user image and ease of use for basic operations but the new features are something else.

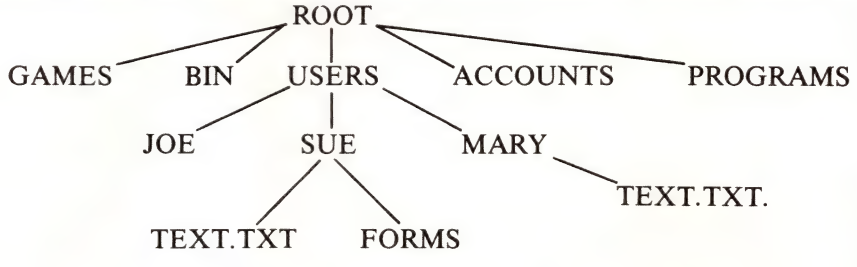

Fig 1 The hierarchical directory structure. The root directory contains directories of programs and files called GAMES, BIN, ACCOUNTS and PROGRAMS, plus a directory called USERS. USERS in turn contains directories called JOE, SUE and MARY. Both SUE and MARY have subdirectories called TEXT.TXT and SUE also has one called FORMS.

NEW FEATURES

The major addition is the provision of a 'hierarchical directory' system. This is jargon for a system which allows the user to group files together on a disk, give the group a name and perform various operations — list the directory or move files, for example — using just the group name. But it's a little more complicated than this. The directory system works in a tree-structured fashion, illustrated in Figure 1. The system starts with a 'root' directory which might, for example, contain major program files. You can then proceed to create subdirectories, each containing in turn a list of programs or data files. And these in turn can contain the names of sub-sub-directories. . . and so on.

Having moved down the tree to a particular directory, you can perform tasks on files in other directories using a pathname. As an example, suppose you are in a directory called PETER which contains a directory called FRED which in turn contains a text file called LETTER.TXT on which you wish to work. You would define the path leading to this as PETER/FRED/LETTER.TXT.

Defining pathnames is rather complex (lack of space prevents me from going into the gory details in full here) and really needs the user to maintain a sort of mental map of the disk's directory in his/her head if anything other than the simplest paths are required.

The advantage of all this may not be immediately obvious, especially when you see how you have to specify which directory you want to work on or move to. In fact on an ordinary, single-user floppy disk system it's more of an unnecessary frill which, I suspect, most users will ignore. It comes into its own, however, on a hard disk system where, as things stand at the moment, asking for a directory listing can result in dozens of file names whizzing up the screen at a fair old rate of knots. It's also useful on multi-user systems, where every user can have his or her own directory — but as I've so often said in the past, multi-user micro systems are pretty pointless.

It's perfectly possible for a user to work with MS-DOS 2 without ever bothering with the hierachical directory structure and I suspect that this is exactly what most end users will do. For the moment you start to use such a feature, you need to understand fully how it works and that, frankly, is something which many business users will simply not want to take the time to do.

Likewise, the 'pipe' facility may confound many first-time users to the point at which they may never use it. Pipes allow you to automatically use the output of one program as the input of another. A prime example is the SORT utility which comes with MS-DOS 2. As a simple example, you could ask for a directory listing and use

Command	Type	Purpose
BREAK	I	Turns on or off the facility for aborting a program by typing Control-C
CAT	E	Sorts and formats a disk directory
CHDIR	I	Changes the current directory in which you're working to another
CHKDSK	E	Displays and optionally fixes inconsistency in a specified directory
CIPHER	E	Encrypts and decrypts a text file, using a user-specified keyword
CLS	I	Clears the screen
COPY	I	Copies one or more files from one disk to another, renaming them if required
CTTY	I	Allows you to change the device used for input and output
DATE	I	Displays and allows you to alter/set the current date. The date and time are automatically included in directory entries.
DEL	I	Deletes specified files from a disk or directory
DIR	I	Displays the files in the current directory if used alone or in another directory if used with a pathname
DISKCOPY	E	Copies the entire contents from one disk to another, over-writing anything on the destination disk
ECHO	I	Normally the commands in a batch file are displayed on the screen as they are executed, but this can be suppressed using this command
EXIT	I	Exits the command processor of MS-DOS and returns to the previous level, if one exists
FIND	E	Searches for a specified text string within a text file or files
FOR	I	Used in batch files to allow loops to be set up
FORMAT	E	Formats the disk in a specified drive and optionally puts a copy of the operating system onto it
GOTO	I	Yes, means just what it says; one of the powerful batch file commands
IF	I	Conditional statement used in batch files
LOCATE	E	Turns '.EXE' (executable) files into binary format, giving faster-running programs and saving disk space
MKDIR	I	Creates a new directory
MORE	E	Sends output to the terminal a screenful at a time and waits for the user to hit return before displaying the next screen
PATH	I	Sets up a command path
PAUSE	I	Suspends the execution of a batch file
PRINT	E	Prints a text file on the printer while you are performing another operation
PROMPT	I	Changes the MS-DOS command prompt
RECOVER	E	Allows you to recover at least part of a file or disk containing bad sectors
REM	I	Allows you to add comments to a batch file which are displayed during execution
REN	I	Renames a file
RMDIR	I	Removes an *empty* directory from a directory structure
SET	I	A rather esoteric one, this, which allows you to set up one text string as equal to another for use in some applications programs
SHIFT	I	Allows more than 10 parameters to be passed to a batch file
SORT	E	Sorts a file alphabetically or numerically
SYS	E	Transfers the operating system (which actually consists of several files) from one disk to another

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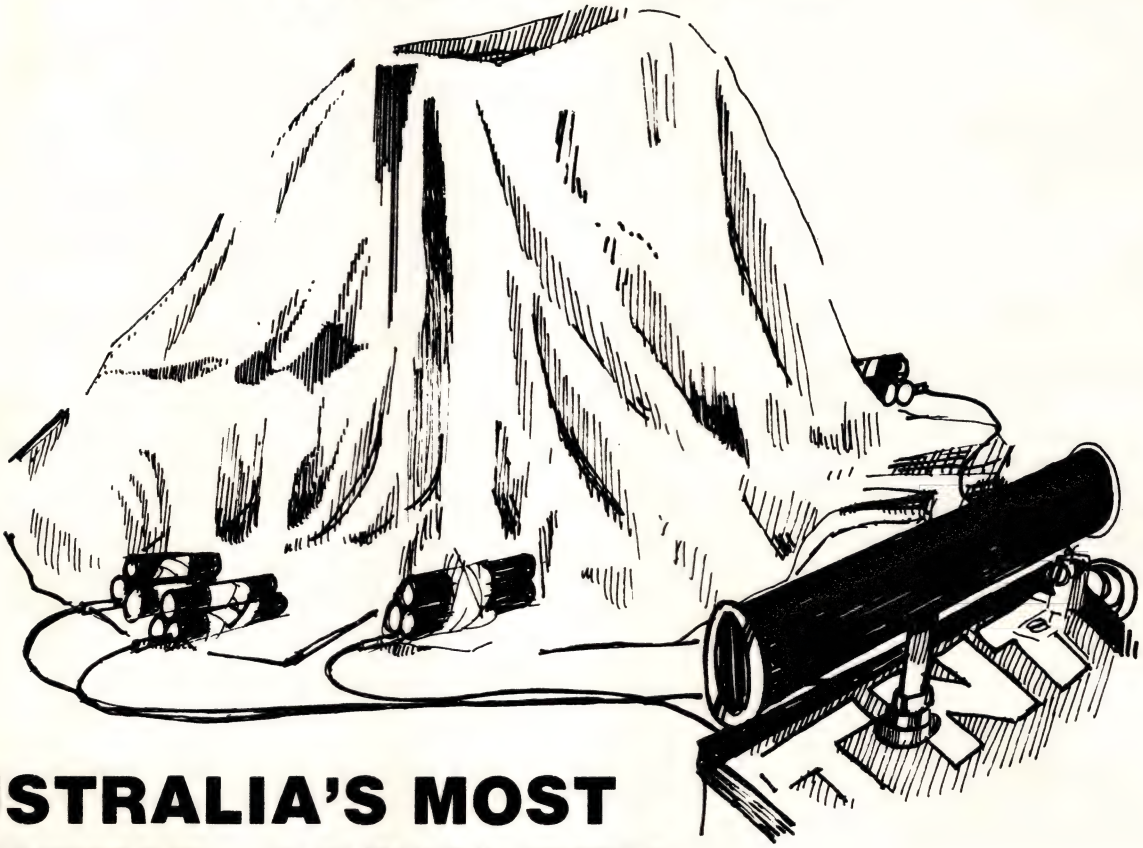

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TIME	I	Displays and allows you to alter/set the time; like the date, this is added to directory entries
TYPE	I	Displays the contents of a text file on the screen
VER	I	Shows the operating system version number
VERIFY	I	Turns on/off the disk write verify facility.
VOL	I	Displays the disk volume number, if there is one

Fig 2 MS-DOS 2 commands

SORT to sort it into alphabetical order and put the result into a text file called LIST with the command DIR : SORT >LIST. The ':' denotes a pipe which carries the output of the first command or program to the input of the next one; '>' redirects the output of a program, in this case to the file LIST. Using '>>' rather than '>' would *append* the output to the end of LIST.

SORT is one of a series of features called 'filters' which can be fed with the output of a command or program. Other filters are CIPHER, which encrypts/decrypts a text file, FIND, which will find a text string within a file and MORE, which will display text output on the screen a screenful at a time and wait while you read it.

Pipes are, I feel, easier for the computer novice to understand than the directory structure but again my hunch is that many users won't bother too much with them. Business computing is moving rapidly to the stage where a computer — to the user — ceases to be a computer and becomes a piece of office equipment to be regarded in the same light as, say, a typewriter or a photocopier; it will be purchased and used with the same attitude as are these pieces of equipment. The trend demands that suppliers sell machines which are ready to perform the desired tasks in response to very simple, easy-to-understand commands. Fortunately, MS-DOS 2 contains excellent facilities to allow the supplier to set up all operations with batch commands.

A batch command is, simply, a text file containing a list of commands. The file name must end with '.BAT' and is activated simply by typing its name as though it were a program. There's no equivalent of CP/M's SUBMIT program, which provides a batch facility but requires you to type SUBMIT ERIC to activate the batch file ERIC.

One batch file name is reserved for special use: AUTOEXEC.BAT. Any file with this name will automatically start to be executed when the system is turned on or reset, allowing a 'turnkey' system to be established which will automatically start running without any commands being typed in by the user at all. As an example, a file called NEWDISK.BAT could be created containing the following:

FORMAT B:
DIR B:

This would be activated by typing 'NEWDISK' and would format a blank disk in drive B and display its directory.

Up to 10 parameters can be passed to a batch file to allow you to use one batch file to perform several tasks. Our previous example could be re-written

FORMAT %1:
DIR %1:

and activated by typing NEWDISK A or NEWDISK B, depending on which drive contained the blank disk; the '%1' would then automatically be replaced with 'A' or 'B' throughout the batch file.

A number of other new commands have been added to MS-DOS and I have listed all commands — old and new — in Figure 2. Some of these commands are internal, ie they are built into the operating system and are activated immediately you type in their names, while others are external and take the form of separate programs residing on disk.

This is really a brief overview of MS-DOS 2 based on a morning spent watching it being put through its paces. Obviously the first machine to benefit from it will be the IBM Personal Computer and other machines are expected to follow soon. Without wishing to boast, I'm writing this just before setting out to California for the West Coast Faire and visits to a number of companies, including Digital Research and Sirius, where, with luck and/or persuasion, I might be able to see and even pick up Sirius versions of both MS-DOS 2 and Concurrent CP/M-86, thereby getting more first-hand experience of using both in my continuing search for the perfect operating system. I don't think that either will fit this description but we're getting closer and I'll keep you posted.

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RELIABLE CODE
MAKE YOUR MICRO WORK

Ric Wickham gives some pro-standard programming tips.

I am a systems programmer by profession. I have a part-share in a System 80 which I use in my spare time to run astronomical simulations and, of course, games. My applications tend to need large volumes of fast code. In this context, 'large' means I need a shoehorn to get it into the 16k machine and 'fast' rules out the Basic interpreter. Since I only have the machine part-time I can spend a lot of time on design and coding; but when I have the machine I want to run programs, not debug them.

This has led me to a standard programming style and environment which has significantly improved the reliability of my programs, though at a slight cost in performance. The style is modular, heavily beset with conventions (mostly enforced by a macrogenerator) and compact. The ideas involved are not original, though I believe this is the first time they have been applied to micros. They come from a number of sources, notably the GIER Algol compiler of the early sixties.

Reliability

How do we ensure reliability? Firstly, by ensuring that all common programming errors are detected.

The Z80 code is very bad for this. The only hardware check is for 'overflow' which doesn't usually mean quite what I expect! Data and control stacks are muddled with no established protocol to sort them out so an extra PUSH or POP instruction can cause the next Return to transfer control to a data address; and jumping to address Ø (a typical result of leaving out a module in a multi-module program) resets the machine.

All the checks must be coded in so I use the macrogenerator. I have standard subscription macros which check bounds; a macro for calling a procedure in another module which checks that it's there; and standard multiply and divide procedures which check overflow. (So far, overflows on addition and subtraction haven't hurt!)

Secondly, by ensuring that all detected errors are reported adequately. Again, the Z80 code is unhelpful. State-of-the-art on large machines (and some small ones) is a stack print giving the names of all procedures entered with the current values of parameter variables but this implies a considerable set of conventions. To be able to make such a report, the error-handling routine must always be able to find out the state the machine was in when the error occurred; this implies that the control stack must always be in a 'clean' state, even when processing an error (such as calling a missing procedure) which occurs halfway through updating the control stack.

Then, never lose control. In this context, 'losing control' is when the machine jumps to a random address. The best run-time system in the world is useless unless you are actually obeying it! Related to this is another point: if your program loops it should be possible to regain control without resetting the machine (if possible, without losing the state of the control stack).

What can we trade?

Nothing's free. I can do without some performance — although Basic is too slow, I don't need the ultimate in machine-code performance. I don't mind having to run all my programs through a macrogenerator before I assemble them. In fact, I welcome it since I can unload a lot of book-keeping onto the machine. Again I really don't care if no-one else can use my routines (or even read my files!). I have a fairly large set of routines in my run-time system, about 2½k. I find this no disadvantage: for small programs I don't mind using the space and my large applications are so similar that I need most of the package anyway.

Consider the fragments

Any program is built up of short sequences of instructions to perform simple operations — for instance loading a variable, adding a constant, calling a procedure, loading a formal parameter (within a routine), identifying an actual parameter (before calling a routine), and so on.

In fact, the operations I've just listed are among the most common fragments and their implementation matters more to a coding standard than anything else. Get these right and your machine will love you; get them wrong and your programs will always be bulky and/or slow and/or just plain unfriendly!

Consider loading a value. If the value is in a fixed place say at 'addr', the load only needs one instruction,eg,

```
LD HL,(ADDR)
```

whereas if the value is on the stack, 'addr' bytes above the stack pointer (as is typical for programs with recursive procedures or dynamic space allocation) you need

```
LD IX,SP
LD L,(IX+ADDR)
LD H,(IX+ADDR+1)
```

which is not just more instructions; the instructions themselves are longer. Moral: don't keep things on stacks!

In fact, the Z80 code is very heavily biased towards fixed places for things. Given this, it makes sense to pass parameters to procedures by address: the addresses of things are constant and so can be permanently assembled into the program, so that the caller of the routine doesn't need to have any code to pass a parameter. This reduces the size of a call at the expense of a slight increase in the code required to access the parameter from inside the procedure. This must be the right way round since there's usually more than one call per procedure: so we optimise the calls.

The solution

Having covered the background, the solution is fairly straightforward.

1. All variables are statically allocated. Addresses are therefore fixed by the assembler. (Actually, they're fixed by my loader but that's a different story!)
2. All procedure calls are indirect. Calls to procedures in the run-time system, for

instance the multiply routine, are all made by a CALL to fixed addresses containing jump instructions; I can therefore replace bits of the system, or move them around, without needing to change any programs that use it. Calls to 'user' procedures, that is, those in other modules of the same program, specify a 'procedure number' to a call on the Base. There is a vector of indirect addresses indexed by procedure number, this vector is used by an indirect-call procedure in the Base to find the procedure the application is actually trying to call. The vector is called GVEC and is in a fixed place, so application modules can have GVEC initialisations compiled in.

3. Parameters are passed to Base procedures in registers in a more or less ad-hoc fashion. All these procedures are wrapped in macros which remember which registers to put things in, and the values of the indirect addresses.

4. Parameters are passed to application procedures by address. Since these addresses are constant, an appropriate number of pointers are assembled in-line in the code following the call. The procedure using the parameter value can read the addresses from a fixed area in the procedure header: it is the responsibility of the Base indirect call procedure to check that the right number of addresses have been supplied and copy them to the parameter area of the called procedure.

5. Since, from the point of view of the called routine, the parameter pointers are at fixed addresses, recursion is not possible. The procedure header therefore contains an 'entered' flag which is inspected by Base during the call to prevent recursive calls.

6. In order to keep the control stack 'clean', there must be no temporary variables on it while a call is in progress. This limits the scope of temporary variables to a single expression, which I regard as a good thing, since experience suggests that I can't remember what I've got on stack much past a dozen instructions!

Implementation

Base comes in three parts. One interprets command letters typed by the operator. This allows him to request that a module be loaded, a program run, stopped, dumped, restarted, and so forth. The second part is a set of diagnostic routines which print the current state of the program to the monitor screen. The third is a set of service routines. Some are completely general and can be called either from the application or from other parts of Base: for example, there's a routine to turn an integer into the string which represents it; and another to print the resulting string. The others can be called only from the application, because they may switch stacks from the user stack (for instance, if they have to report errors).

All Base routines are called indirectly in an ad-hoc fashion. This is supportable because all Base routines are trivial, designed to perform a single closely-specified function: the specification isn't going to change and (because the routines are indirectly-addressed) the address of the routine isn't either. Incidentally, one reason all Base routines are so simple and well-specified is that I had to prove they work by inspection because I can't use Base to test them. This is good discipline if you can stand it!

Application routines are called via an indirect procedure ICALL. ICALL is called by a restart instruction (RST 56, which happens to be spare on a non-disk Genie). It could be called by an ordinary CALL instruction but the restart is smaller. The restart is followed by a byte containing the procedure number; this is followed by a byte containing the number of bytes of parameters supplied on this call. The parameters then follow, in the form of pointers.

Thus, to print a string at MSG with procedure number PRINT:

```
RST 56
DEFB PRINT
DEFB 2          ; A pointer is two bytes
ADDR MSG        ; Address of the string.
```

It's worth noting, in passing, that this sequence occupies five bytes; the standard way of printing a string on the System 80 is

```
LD HL,MSG
CALL 28A7H
```

which is six bytes.

The target routine has a header which starts with a recursion flag, then contains a byte giving the number of bytes of parameters expected, space for the parameters, a byte containing the length of the name of the procedure, the name, then the code. The indirect procedure address points to the start of the header. The procedure name must contain a zero byte so a parameterless procedure with a zero-length name carries a standard overhead of four bytes.

As an example, the header for the PRINT procedure above could be as in Fig 1.

The recursion flag is -1 initially so that ICALL can say

```
INC (HL)
JR NZ, fault
```

rather than messing about loading the flag and comparing it.

Each procedure call results in three words on stack. First is the return address to the next byte after the supplied parameters in the call. Next is the address of the called routine: PRINTX in the given example. Finally, since ICALL calls the target procedure, there is on-stack a return address in the middle of ICALL. This is so that the target procedure can return simply by saying RTN, which will drop it into ICALL again at a suitable place to interpret the procedure return. This place is actually called IRTN.

The sequence of events around a call is therefore:

— calling procedure calls ICALL
— ICALL calls called procedure
— called procedure returns to IRTN
— IRTN returns to calling procedure.

How the procedures work

Base initialises GVEC to all zeros: therefore, if you try to call a routine you haven't loaded, its address will be 0 and ICALL can reject the call. There is almost no other initialisation.

ICALL is the most complex procedure. It and IRTN work in nine major steps:

1. Access GVEC to find where the target procedure is; report an error if it isn't loaded.
2. Increment the recursion flag of the target procedure and report an error if it doesn't become 0.
3. Compare the number of parameters supplied in the call with the number expected by the target procedure; report an error if they're not equal.
4. If any parameters are supplied, copy them to the target procedure header. This is a single-instruction block move, of course.
5. Stack a pointer to the called procedure.
6. Call the first instruction of the called procedure.

When the procedure executes a RTN instruction, IRTN will

7. Unstack the procedure pointer.
8. Use the unstacked value to decrement the recursion flag.

```
PRINTX      EQU *                   ; Declare a local label as 'here'.
            ORG GVEC+PRINT+PRINT    ; put the address of this routine into
            ADDR PRINTX             ; the indirect call vector.
            ORG PRINTX              ; and continue to generate the routine
            DEFB 255                ; Recursion flag.
            DEFB 2                  ; 2 bytes of parameters.
STRING      DEFS 2                  ; 2 bytes space for parameter.
            DEFB 6                  ; length of name of routine.
            DEFM 'PRINT'            ; the name itself. .
            DEFB 0                  ; . . terminated by zero.
; The actual code for the procedure starts here; for instance
            LD HL,(STRING)          ; to load the address of the
                                    parameter.
```

Fig 1

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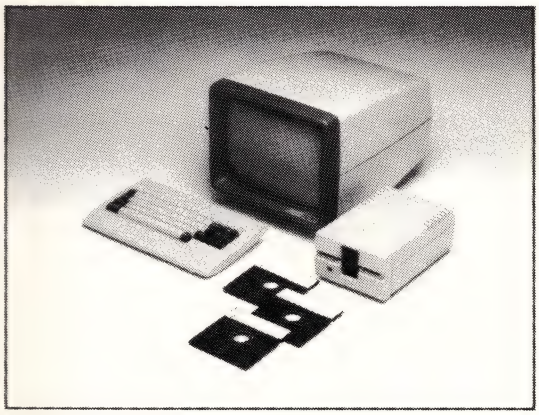

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RELIABLE CODE

9. Return to the original caller.

As an added bonus, both ICALL and IRTN inspect a flag in a fixed place and, if it is non-zero, print the name of the procedure being entered or from which control is returning.

The other interesting procedure is the dumper. This routine simply runs up the stack in three-word groups; for each procedure entered it prints the address of the caller (the original return address), plus the name of the procedure (from the string in the procedure header, which it finds from the stacked procedure pointer). It could also print the values of the supplied parameters, though my present version doesn't. If I ever need to implement that I'll extend the 'name' field in the procedure header to include a specification of the type of each parameter (word,byte,vector of byte, so forth). This is possible because the name is terminated by a zero byte and the total length of the field is supplied explicitly; so the supplied length can be longer than required for the name.

Frills

As I mentioned above, it is possible to set a flag in a known place, either by command to the interpreter or from within the application, which will cause ICAll and IRTn to print the name of the procedure being entered or left.

Not so much a frill, more a necessity is 'unwind'. Obviously, if you run a program and it fails, it will leave recursion flags set on a number of procedures, including the main program. Any attempt to re-run the program will therefore fail. Unwind is a procedure which can be called by an interpreter command to run up the stack unsetting the recursion markers of all the procedures that it finds. One day I'll get around to making the RUN command do it automatically when required; for the moment I invoke it manually.

Many of the routines in Base which can only be called from an application call a 'coordination' routine. (The term 'coordination' was coined for a routine in the George operating system that performs the timeslice function). This routine looks to see if the 'Break' key is being pressed; if so, it suspends the program. This is extremely useful for breaking into loops. The coordinator is called by ICALL and IRTN, by the multiply and divide routines, subscript calculation and indirect fetch. Between that lot, it's quite hard to accidentally write an endless loop that the Break key won't get you out of; but, for the pathologically loop-happy (me!) I also have a set of loop-construction macros covering all the normal forms of loop which call the coordinator directly.

If you really must have recursion (for instance for Pascal programs) you can achieve it at high efficiency by putting local variables in the parameter area (with their own length byte!) and copying the parameter area 'somewhere else' (to an auxiliary stack, which could be interleaved with the control stack) if the recursion flag becomes non-zero when you increment it. On the first entry, when the flag becomes non-zero, the area contains rubbish. Of course you have to reinstate these old values when you leave the procedure.

Note that all variables remain statically allocated. (This implies that you can't have dynamic arrays.)

Note also that the copy of any given variable in a recursive nest which is 'visible' according to the Algol and Pascal scope rules is the statically allocated copy: the stacked copies are all invisible anyway. You don't need what an Algol implementor would call a 'Display Vector' to find things. (This is not strictly true of certain procedures which are passed out of their declaration scope as parametric procedures to other procedures: you can't implement Algol 'call by name' like this.)

Note, finally, that by the time you have the extra code to administer the auxiliary stack and the rather general version of UNWIND required to be able to cope with a jump out of a procedure, you haven't much space for program in 16k! For my applications, recursion is too much of an overhead.

By a little planning it's possible to provide an environment on TRS-80 style machines that allows sensible detection and reporting of programming errors while maintaining high space-efficiency and reasonable speed. END

BENCHTEST

NEC APC

by Steve Save

The NEC APC has been available in Australia for nearly a year now. It is an interesting point of time to write a review on a piece of hardware in as much as there can be no promises of things to come — the product is finished and is being marketed exactly as has been presented for reviewing. The review machine was the middle of the range twin floppy monochrome model. By all accounts a very standard configuration until it is examined more closely. The designers obviously had in mind a machine that was going to be used as a "general purpose" office tool that wouldn't object to a high volume of throughput and retain the reserves that may be required in the future. Outlined below is a brief synopsis of the review system and an outline of some of the other options available.

Range

There are three available configurations in the current range. The base model comes with a green screen, 128k of memory and a single disk drive. The next model is identical except for an additional disk drive. The top model is a further upgrade on the original design with the addition of a further 128k of memory and colour graphics screen. Of the three models the monochrome twin floppy model is by far the most practical and hence the most popular. For the sake of expediency I will concentrate on this model with a brief description of the differences later. The basic components of all three models are the same so the comments are pertinent except for the differences already mentioned.

Keyboard

The keyboard on the APC is so versatile in itself that it bears a detailed examination. The physical characteristics of the keyboard, are not outstanding and by comparison to, say, the DEC keyboard is dated. This is due to its size mostly. For such a recent entry to the market I would have expected a more slimline design. It appears that the designers were not overly pressured by current fashions — which when all said and done really amounts to nothing anyway. As a work tool the appearance has little or no relevance — only its useability. In this respect the APC keyboard has more features than could be possibly needed. It has a standard QWERTY type keyboard with a numeric keypad. Within the numeric keypad there are several additional control keys for cursor positioning. Along the top of the keyboard are a further 22 user definable keys which when used in conjunction with the super-shift feature allow a total of 44 functions to be assigned to a single key stroke. Personally I cannot think of 44 functions that I would wish to assign. There are two graphics mode keys which act as super-shift changing the values of all keys. As standard the APC has a 224 character set with the capacity to accept a further 256 user defined characters. Each of the characters is made up by an 8 by 19 dot matrix which allows for a vast amount of scope in character composition.

Screen

The green phosphor screen as supplied with the evaluation unit was of an extremely high quality. It is, of course, manufactured by NEC. It is a 30cm screen with a resolution of 640 pixels by 475. This makes it a very readable display which is important if the machine is going to be used daily for prolonged periods. Basically, the higher resolution the less your eyes are strained. As mentioned earlier, there is a total of 480 different characters which may be displayed on the screen. Once again, due to the quality of the display, they are all quite clear and legible, including the graphics characters. The display format is the standard 24 lines by 80 characters with an additional status line. This is the first machine I have seen with the status line at the top of the screen. Initially I paid no attention to this feature and it wasn't until I was using the unit as a work tool that I noticed that it was by far a better way of presenting the status line. It leaves the screen uncluttered and easy to read — another point that leans towards the practicality of the overall design.

Disks

The disk drives on the APC are an 8 inch slimline design. They are built right into the cabinet as opposed to the usual pattern of inserting a drive into a slot and exposing the front. The gate mechanism is a part of the cabinet and each drive has a clearly marked identification panel with two status lights. These lights are used to inform the operator when a disk is loaded and when it is in use. The capacity of the disks is just under a megabyte each. The standard format is double sided, double density but the APC has the ability to read IBM 3740 format disks (single sided, double density). This is achieved with absolutely no inter-vention on the part of the operator. On other 8 inch systems that I have used, it is normal to be able to address 3740 format but the effort that is sometimes required seems out of proportion to the end result achieved. On the APC all that is required is for the operator to insert the disk and the machine takes care of the decision making with respect to the actual format to be used. This feature will become a standard on all equipment and it is to NEC's credit that they led with this particular innovation. It does make the machine an extremely usable device with none of the usual drama that surrounds disk formats.

Processor

The NEC APC uses an Intel 8086 processor chip as the main processing unit. This is a 16-bit processor which allows the management of more user available memory functions than would normally be found on a comparable 8-bit computer. Personally I have been somewhat sceptical as to the merit of 16-bit processors over 8-bit. The reasons for this have been based entirely on the available software and to a certain extent this is still true. With the APC, NEC has taken advantage of the available functions to an extent that even though there is still a lack of application software the unit is ensured of a long future and for a business that had limited immediate applications but envisaged a developing workload the APC would be a good choice of equipment. For someone purchasing a business system at present this would be almost universally true.

The translation of 8-bit software to 16-bit is steadily taking place and it will not be too long before that transition is complete. The likely step after that is for all new software to be developed for processors that use more than 8-bits (not necessarily 16) and hence the overall situation will be reversed. There will be less available software for 8-bit computers than for others. This process is being accelerated by the acceptance of CP/M 86 as the new standard in operating systems. This is also quite logical because of the proliferation of available software currently available for use with the long time favourite CP/M (now CP/M 80). As well as the central 8086 processor there are a number of ancillary processors for controlling the peripheral interfaces. These include a uPD 765 disk controller and a DMA controller which takes care of disk and screen transfers. An interesting option is the Intel 8231 arithmetic processing unit which should more than satisfy those with a scientific inclination. For those of a more artistic leaning there is also sound generation hardware. (The appraisal unit played a terrible rendition of Bach.) Another processor feature is the ability to turn itself off under program control. The mind boggles at the concept.

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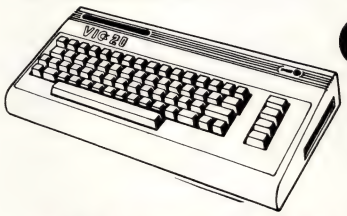

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NEC APC

As well as supporting their operating system NEC also supports an increasing range of compilers and application software. These include Ryan-McFarland's RM-Cobol which is already widely used on a range of existing mini-computers. This makes available the use of some very sophisticated software which has been in use for many years. CBASIC-86 is also supported as well as Pascal/MT+86. With the release of CB-86 (compiled Basic) imminent, the range of available software will increase to the point that it will only be the fussiest of users that will find cause to complain about available application software.

Benchmark Timings

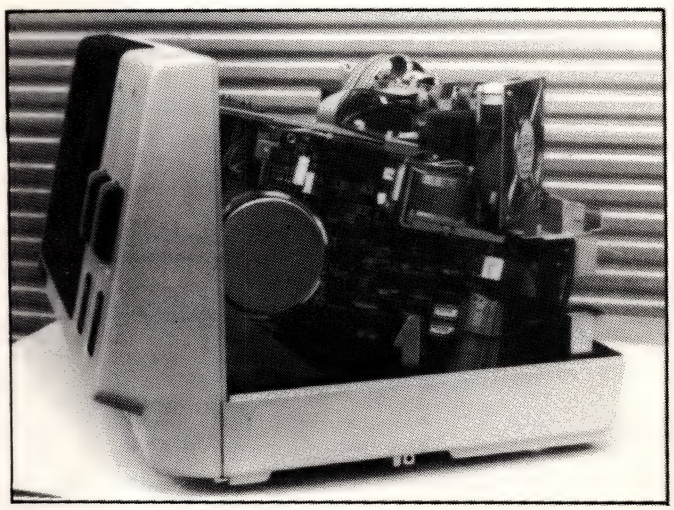
As you will see from the benchmark timings the APC is not a particularly fast machine in its standard form. In fact it is very slow. It is to be hoped that the timings would considerably improve with the addition of the Intel 8231 arithmetic processing board. For those that are interested the Benchmarks were executed with CBasic-86 and adhered to the programs as specified in *APC* Vol. 3 No. 11.

Conclusion

The NEC APC is a well made and versatile system. Despite the Benchmark timings I still feel there will be a good future for the APC. If the powers that be happen to be reading this review it may be worth their considering the addition of the arithmetic board into the standard unit and then it may deserve the honour of "Computer of the Year". Even so, there is little doubt that the NEC APC is going to be with us for a while and that it will serve its masters well.

Benchmark timings

BM 1	4.4 Secs
2	7.4 Secs
3	31.8 Secs
4	50.5 Secs
5	50.5 Secs
6	82 Secs
7	96 Secs
8	78.9 Secs



Inside the NEC APC

Software

As mentioned earlier, NEC is currently supporting their own implementation of CP/M 86. There is still little activity surrounding the NEC version of MS DOS. The version of CP/M 86 used by the APC is well implemented and personally I can see no reason for NEC to supply any more than they have already made available.

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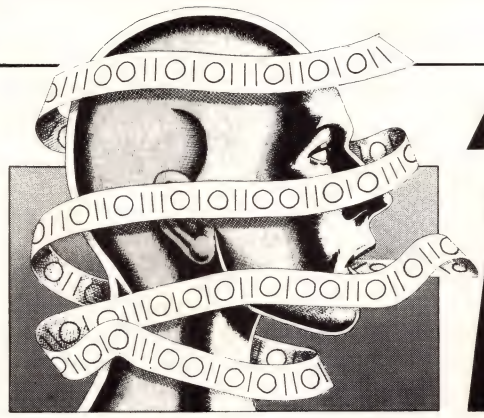


AN INTRODUCTION TO LISP

J P Bennett presents a powerful language in a readily digestible format.

In the first of two articles on Lisp I shall explain the structure and use of one of the oldest high-level programming languages. In the second article David Johnson-Davies will present and explain a large Lisp program, Eliza, which will run on most micro implementations of Lisp, mimicking the questions asked by a psychiatrist during a consultation.

Lisp is a very old language. The ideas behind the languages were first put forward by John McCarthy and his associates at Massachussetts Institute of Technology (MIT) in the late 1950's, around the time Cobol was invented, two years before Algol was thought of, eight years before the Fortran standard was published and a decade before Basic became popular. Remarkably, Lisp is now used more than ever before and has provided the basis for the new fifth generation languages, such as Logo and Prolog.

The uses of Lisp have been widespread. The best known are in artificial intelligence, of which the Eliza program to be described in the next article is an example. However the language's underlying strength in symbol handling and the ease with which Lisp programs are modified and extended, have led to its use in high precision arithmetic and algebraic manipulation, and recently to Atari's use of Lisp machines for high speed testing of new game ideas.

Lisp stands for LISt Processing language. A program consists merely of a list of functions to be evaluated. Exactly what is meant by a list will be explained later. More important first is the use of functions throughout Lisp.

We are used to functions in Basic, such as:
SIN (3.14159)
LOG (2.71828)
CHR$ (30)
We are also used to expressions such as:
3+2
4*3
6+5*7
Such expressions could however be written as functions
PLUS (3,2)
TIMES (4,3)
PLUS (6,TIMES(5,7))

This is how such expressions have to be written in Lisp. They may seem verbose, but they do have advantages. Bracketing of expression is no longer necessary. If we want the last expression above to be evaluated as:
(6+5)*7
Then we write:
TIMES (PLUS (6,5),7)
and the meaning is clear from the order of the functions.

Lisp uses a slightly different notation known as S-notation. Instead of:
PLUS (3,2)
we write:
(PLUS 3 2)
Spaces rather than commas separate items, and the first item is a function to apply to the rest of the items. Brackets go round the outside to indicate that this is a single unit, capable of evaluation on its own to yield the value 5. This strange bracketing eventually becomes familiar, but is a common source of programming errors with beginners.

The previous expressions are then written:
(TIMES 4 3)
and
(PLUS 6 (TIMES 5 7))

All the features of normal programming languages can be used as functions. For instance the Basic statement:
LET A = 3 (or just A = 3)
becomes:
(SETQ A 3)
and similarly
IF A < 0 THEN PRINT "NEGATIVE"
ELSE PRINT "POSITIVE"
becomes:

```
(COND
  ((LESSP A 0) (PRINT 'NEGATIVE))
  (T (PRINT 'POSITIVE)))
```

The COND function is in fact slightly different, and rather more general than the Basic IF statement; it has the general form:

```
(COND
  (condition1 expression1)
  (condition2 expression2)

  (condition  expression ))
```

Each condition is evaluated in turn until one is true, and then the expression following is evaluated and returned as the result of the COND function. If no condition is true then the special value NIL, (of which more later) is returned. The conditions used above were:
(LESSP A 0)
The function LESSP returns true if its first argument is less than its second.
and
T
an item, not a function whose value is always true.
and the expressions used were
(PRINT 'NEGATIVE)
and
(PRINT 'POSITIVE) Which do the obvious

New functions are defined by using the built in function DEFUN (in some versions of Lisp called DE instead). Thus we could define the factorial function as:

```
(DEFUN FACT (N)
  (COND
    ((EQ N 1) 1)
    (T (TIMES N (FACT
(DIFFERENCE N 1)))) ))
```

Note the use of indentation to make the meaning clear. The function DEFUN takes any number of arguments. The first is the name of the function being defined, the second is a list of arguments (in brackets), and the rest are functions to be evaluated when the function is used. The result returned when the function is called is the value of the last expression evaluated.

This definition of FACT is recursive—it calls itself. Thus factorial 3 would be:

(FACT 3)
which is evaluated as:
(TIMES 3 (FACT 2))
which is:
(TIMES 3 (TIMES 2 (FACT 1)))
now (FACT 1) is 1 (N being now EQ to 1),
and so this becomes:
(TIMES 3 (TIMES 2 1))
ie, 6

Lisp relies heavily on recursion, since it has no looping structures, such as the FOR-NEXT or REPEAT-UNTIL of Basic, nor does it have GOTO statements, at least not in pure Lisp. If you want to do something more than once you have to do it recursively. For instance the Basic program:

```
SUM = 0
FOR I = 1 TO 10
SUM = SUM + I
NEXT
```

could be evaluated by a recursive function such as:

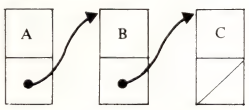
```
(DEFUN LOOPSUM (I)
  (COND
    ((EQ I 10) I)
    (T (PLUS I (LOOPSUM (PLUS
I 1)))) ))
```

and the result could be put in SUM by:
(SETQ SUM (LOOPSUM 1))

This is the second problem for beginners. Recursion is a concept that does not come easily, particularly if you are used to Basic. In practice it takes some time for novice programmers to start to appreciate its use, and then to realise that it is the most powerful programming tool available. Once you do get used to it you will wonder how you managed without it.

Now to return to the lists mentioned earlier. We have already seen several lists:
(PLUS 3 2)
(TIMES 4 5)
and so on. Any series of items inside brackets is a list. Thus
(A B C D)
is a list, and
((A B) (C D))
is a list of lists.

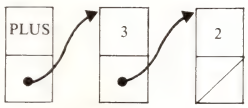
In Lisp anything that is not a list is called an atom, since unlike lists, atoms are indivisible. Let us look more closely at a simple list:
(A B C)
How is this represented in the computer? Lisp handles everything as pairs of locations in the computer's memory. Thus the list (A B C) is represented as three pairs of locations:



The arrows are pointers in the computer's memory. A pointer is merely the address of the location in the computer's memory being pointed to. If we draw some hypothetical computer locations we can see how the above list might be represented:

12 A	13 18
14 C	15 -1
16	17
18 B	19 14
20	21

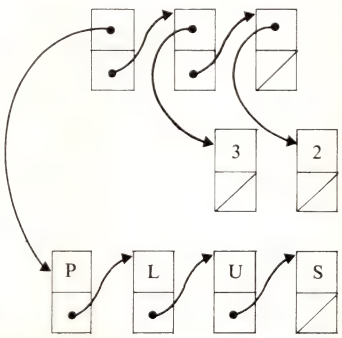
Pairs of locations from 12 to 21 in the computer's memory are shown. Notice how the second field of the A pair holds the address of the B pair, and how the second field of the B pair holds the address of the C pair. The second field of the C pair is -1 to show that this is the end of the list and doesn't point anywhere. Notice how the order of A B and C in memory is unimportant, since the order in the list is all handled by pointers.
(PLUS 3 2)
is also a list and is represented as:



The symbol:

is used to mean 'end of list', and is the special atom NIL referred to earlier, ie, the address of -1 used in the previous illustration.

Practical programmers will realise that while you can fit the character A in one location, you cannot fit the characters PLUS in one location. This is indeed the case and in each of the first fields of the pairs of locations there are pointers, which point to the print names, or values, thus the previous list is better shown as:



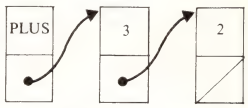
In fact Lisp needs to know whether it has a character, or a number, or a pointer in a location, and so usually a few bits are reserved in each location to show what sort of item is there. You should not make the mistake of assuming that locations in the computer's memory are equivalent to bytes. 8 bits are not enough for holding addresses, and flags etc., and so commonly LISP breaks memory up into 16 or 24 bit locations, for use. This is a mere technicality and should not worry the Lisp programmer, since such things are hidden from him.

By now the underlying uniformity of Lisp should be much more apparent. Both expressions, such as:
(PLUS 1 2)
and data, such as:
'POSITIVE
are represented as lists.

How do you go about "executing" a Lisp program? Most micro-implementations of Lisp operate in 'evaluate' mode. They usually give you a prompt, such as:
'Evaluate:'
You then type in a function to evaluate, such as:

(PLUS 3 2)

and the Lisp system will evaluate it. Evaluation consists of walking over the list representing the function and performing the functions represented. For instance here:



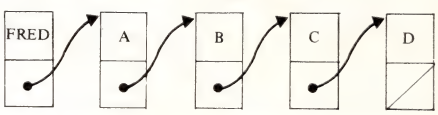
The evaluator encounters the first item PLUS and realises it requires two arguments. It gets these two arguments by following down the pointers to find 2 and 3, adds them and returns the value, typically by a reply such as:
Value is: 5
You will find lists for evaluation such as these referred to in the literature as S-expressions.

Since both programs and data have the same form, programs may be written to modify programs. Lisp provides some rather strangely named functions to manipulate lists. Consider a list FRED
(SETQ FRED '(A B C D))
(Note that the ' merely means don't evaluate this list as though it were an S-expression, but set FRED up to point to it).
The function CAR is used to obtain the first item in the list viz.
(CAR FRED)
will give A.

The opposite function is CDR, to give the rest of the list.
(CDR FRED)
will give (B C D).

The obscure names for these functions stand for Contents of Address Register and Contents of Data Register, and refer to the IBM 709 on which Lisp was first implemented.

Looking at our box picture:



CAR gives the first location of the object referred to by FRED ie,

and CDR gives the second viz.

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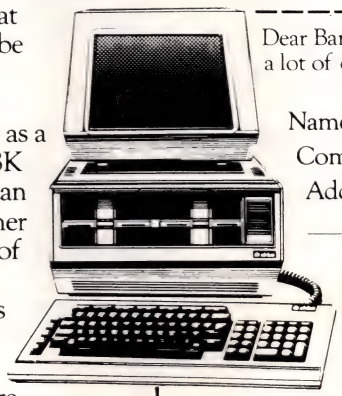

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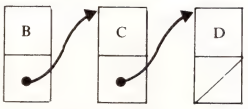

Assorted other functions exist to modify lists in other useful ways.

The power of Lisp comes from the way it is built up from a set of standard functions. These functions are held on a list maintained by the Lisp system, the object list or OBLIST. This initially has useful functions, such as PLUS, TIMES, CAR, CDR and so on. Every time you define a function using DEFUN it is added to this list. Running a program consists of evaluating a function you have defined, which in turn evaluates other functions you have defined on the OBLIST and so on. Thus to extend a program you just add a few functions to the OBLIST you already have and modify existing functions to evaluate them. Program development is fast, because you can test each function on the OBLIST individually before building them into the main body of routines, and also because this type of system encourages a tree-structured program, consisting of important functions evaluated as part of the main function and less important functions evaluated by the important functions and so on down to the very small functions at the bottom of the tree.

This idea of using your Lisp system, surrounded by all the functions you need, is why programmers talk of a Lisp environment and Lisp machines, rather than Lisp program. There is no one entity clearly definable as the program, merely a pool of functions on the OBLIST, all calling each other, in a way that is powerful and flexible. As you work with Lisp you too will discover the addiction for this language, common among all its users.

FURTHER READING

I would not recommend the original report by McCarthy as a good introduction to the language. The best introduction is probably *A Programmer's Introduction to Lisp* by W.D. Maurer, published by MacDonald/American Elsevier Computer Monographs, 1972.

SOFTWARE

WHICH SPREADSHEET?

MULTIPLAN

Mike Liardet looks at Multiplan — Microsoft's entry to the spreadsheet fray.

After releasing the Apple version of Visicalc about three years ago, Visicorp enjoyed at least 18 months completely unchallenged in the market for what has now become known as spreadsheet software. But in the last year and a half there has been a steady stream of Visicalc rivals arriving on the scene and, naturally, some of the established companies have been getting involved in this growth area.

Probably the best known of all the microsoftware companies, Microsoft's pedigree goes right back to those prehistoric days of 'core-store', paper-tape and teletypes — 1975 in fact, when the first of a million microcomputer systems was equipped with a Microsoft Basic interpreter. Now Microsoft has augmented its own spreadsheet system: Multiplan. Will Multiplan further enhance Microsoft's reputation for excellence? Will it be another Ford Edsel? (You should get this point if you have heard of a Ford Edsel and you definitely will if you haven't!)

The first thing that strikes you when confronted with a copy of Multiplan is the packaging: Microsoft has obviously invested a lot of effort (and money as well, I am sure) in presenting its 'new baby' to maximum advantage. A heavy-duty transparent plastic case holds a substantial ring-bound manual, system disks, various leaflets and a few pieces of carefully positioned cardboard mouldings — simply there to mask out awkward gaps and present an uncluttered appearance through the transparent box. Readers who are concerned by such a flagrant wastage of the world's resources on a mere piece of marketing-hype will doubtless be relieved to learn that you need not throw the box away after purchase — it readily converts into a sweet little bookstand to support your manual!

Anyway, underneath the packaging we eventually find the disks — my review copy was for the Apple II (DOS 3.3), but Multiplan is also available for The Apple III, CP/M systems and, of course, Microsoft's MS-DOS. All versions are evidently functionally identical, with just a few pages at the start of the manual outlining any minor differences, so non-Apple owners should still bear with me! (I also had the opportunity to take a quick look at the MS-DOS version on a Sirius, so have made occasional references to this, too. In particular, I have included benchmark results for the Sirius version, specifically to check out Multiplan's performance with a new generation (8088) processor and all that extra memory capacity.)

Getting started

Getting started proved fairly easy — the 'First Time' instructions were not on page 1, where I like to see them, but a little bit of page-thumbing soon tracked them down. A bit of disk copying, data disk initialisation, and two or three minutes later I was faced with a reassuringly familiar display of a spreadsheet. The only hold-up in all this was to have a good chuckle at the latest piece of computer jargon, encountered in the instructions for seeking the system for optional (on the Apple) 80-column display mode: 'Recable' — to exchange 40-column video cable connection with 80-column!

The initial display is of the top left hand corner of the spreadsheet, showing seven spreadsheet columns and 20 rows, all completely blank. The remainder of the display is devoted to helpful prompts: the names of twenty different 'commands', a 'what to do now' message and status information, such as percentage of storage space remaining, current cursor position, etc. Both rows and columns are identified by numbers, unlike many systems which use the alphabet for column headings. The repercussions of this are fairly great, since whereas 'Q99' is unambiguously a reference to a specified cell, '1799' clearly is not. Multiplan provides several alternatives for identifying cells, but the simplest is that they be written as 'RyCx' — eg, 'R17C99' — a little bit longer than 'Q99'!

Moving around

Moving the cursor around the spreadsheet is very simple — single control-key hits (ie, simultaneously pressing 'Control' and one other key) move the cursor left, right, up and down, with the VDU screen window being 'pulled along' by the cursor if an attempt is made to move to a cell off the edge of the screen. Sensibly, the keys that achieve this movement are arranged in a diamond (on the Sirius the arrow keys are used) — easy to remember and easy to touch-type when you are looking at the screen. Further investigation reveals that

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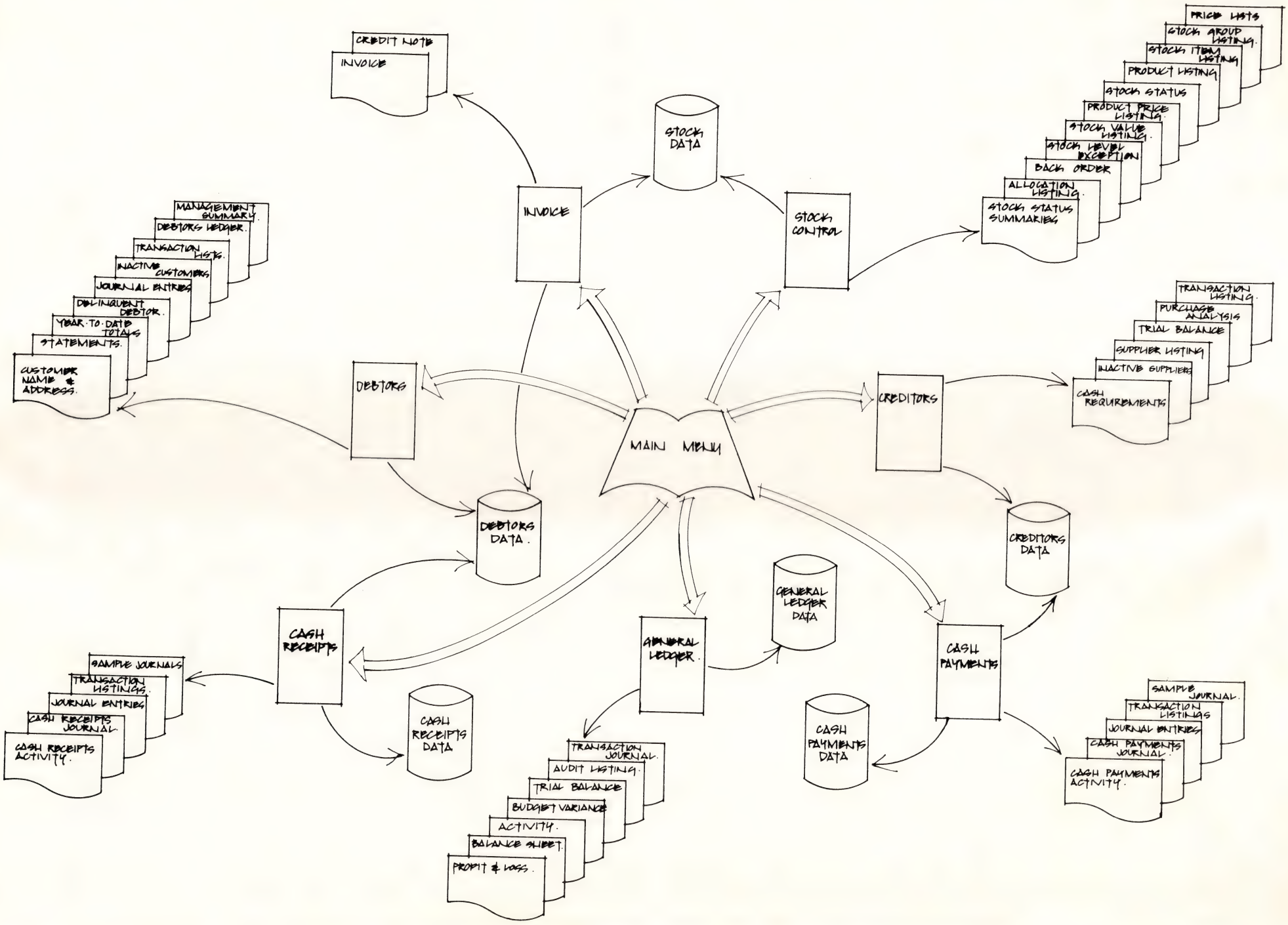
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there are also control-key hits to 'home' the cursor to the top left hand cell and to the bottom-right, and a 'Go-to' command where destination coordinates can be typed in, as well as a rapid scrolling facility where the cursor is moved several cells at one go.

Also of particular interest is a very powerful split-screen facility. The screen can be subdivided into display areas (called 'windows' in the manual), each displaying different parts of the spreadsheet, and the cursor can be quickly 'jumped' from one to the next. There are many possible uses for this: locking row and column headings for continual display, quick movement between different parts of the spreadsheet, and keeping totals or whatever continually in view when other parts of the spreadsheet are being modified. Moreover each window can be displayed with a nice surrounding border, and can also be 'linked' to another window so that columns or rows in both always line up correctly. If all this sounds a little confusing to the newcomer, then take heart. You can completely ignore the facility at first, but once you are ready for it, the chances are that however you want to lay-out your display then Multiplan will accommodate you.

Entering data

As with most spreadsheet systems, the 'bread and butter' activity centres on entering or changing numbers, titles and formulae. To achieve this, simply move the cursor to the cell to be changed and start typing whatever is required there. The only thing to watch out for is that text entry must be preceded by selecting 'Alpha' mode (simply press 'A' before typing the text) otherwise the chances are Multiplan will assume you are entering a command — occasionally disastrous. For example, a sensible abbreviation for Total-Costs-Yacht could be 'TCY'. Enter this without pressing 'A' and Multiplan does a 'Transfer-Clear-Yes', wiping out the entire spreadsheet! Don't believe it could happen? An *APC* editor (I'll spare his blushes) did it! Well, it probably wasn't a yacht, but a yo-yo or a yard-of-ale or something. . .

The formulae themselves can be built up using a wide range of maths and other functions, including trig, standard deviation, string concatenation, logical and table look-up, etc. The notation used is the classic keyboard version of school maths notation, easily learned by anyone not already familiar with it. As we have already mentioned, formula references to cells require an 'RyCx' notation — eg, the formula to add the first 2 cells on the first row could be written as 'R1C1 + R1C2'. However, there is a little trap lurking for experienced spreadsheet users — the replication facility does no formula adjustment whatsoever. Thus, if the above formula was located at R1C3, and then copied to 99 cells below, each and every copy would be 'R1C1 + R1C2', and the expected Column3 = Column1 + Column2 would not be achieved. It turns out that the original formula, quite correct if no replication is envisaged, should be 'RC[-2] + RC[-1]', meaning 'add cell in current row two columns back, to one in current row one column back'. Now, wherever this formula is located, it will add together the two previous values on the row, and in particular, if replicated right down column 3 it will do the column sum correctly.

If typing 'RC[-2] + RC[-1]' seems like a bit of a fingerful (tactile equivalent of mouthful) then Multiplan to the rescue! Instead of working out 'RC[-2]', etc, simply use cursor moves in mid-formula entry and Multiplan will type in the formula for you. In the above example only the '+' need be entered from the keyboard, the rest of the formula being built up by using the cursor to point to the cells to be referenced.

It is also possible to refer to cells by their row or column name and thus build up formulae like 'profit = sales – costs'. Since (a) this is immediately comprehensible and (b) always replicates correctly, the extra typing involved is well worth it!

In conclusion, I must say that I did not greatly like Multiplan's methodology for referencing cells. It should be noted that cell references occur not only in formulae, but are also required by the majority of commands (see below), so a major part of one's time at the keyboard is spent using them. In fairness I must point out that (a) my previous spreadsheet has been with the Visicalc style of cell-reference and (b) that Multiplan has some compensations for this minor irritation with some excellent other features and facilities.

Commands

Thus far, we have looked at Multiplan's basic essential facilities, but of course there are many other, typically more peripheral (in both senses!), functions needed to provide a comprehensive spreadsheet system. These extra functions are provided for by Multiplan commands, and invoked by selection from a command-menu.

Actually, in passing, we have already touched upon four commands provided by Multiplan — 'Go-to' cell, 'Alpha' for entering text, 'Copy' for replicating cells, and 'Window' for the split-screen facility. There are in fact 20 in all, each starting with a different letter of the alphabet, and all permanently displayed at the bottom of the screen. Bearing in mind that there were only six letters of the alphabet to spare, the implementors have done a pretty good job of choosing 20 sensible names — probably the worst one is 'Alpha' (it couldn't be 'Text' because that clashes with 'Transfer' and 'Transfer' couldn't be 'File', 'Storage' or 'Disk' because F, S and D are in use, etc).

Anyway, in the unlikely event that a command's meaning is unknown, or in the more probable event that the precise

Checklist

Documentation: 400+ pages, contents, tutorial, reference, index, quick reference and help-screens. Well-illustrated. Excellent.
User-friendliness: Consistent and easy to use — cell-referencing can be a little tricky!
Error-handling: 20+ error messages. Erroneous calculations (eg, zero-divides) displayed as special error values.
Facilities:
Arithmetic and other functions: +, −, *, /, %, string operations, logic, descriptive statistics, trig, logs, look-up and more besides!
Configuration: version tested easily configured for different types of Apple screen.
Graphics: a let-down compared with the other facilities!
Interface to other software: specifically can read Visicalc files, and print to disk. Can also be interfaced to other software using data interchange format (requires programming skills to do this).
Spreadsheet overlays: yes — can do consolidation or merge information into existing spreadsheet.
Turnkey: Apple version is turnkey with all disk formatting, copying, etc, achievable without recourse to Apple DOS.
Insertion, deletion and replication: yes.
Display flexibility: just about everything you could possibly want. Excellent.
Protected cells: yes.
Formula printout: yes.
Formula editing: yes.
Automatic/manual recalculation: yes.
Out of memory: memory left permanently displayed. Recovers correctly when it runs out of memory.
Long jumps: can jump directly to any specified cell.
Sorts, searching and logic: yes.

NEC gets personal with IBM

NEC designed the new Spinwriter™ 3550 especially for the IBM PC. NEC's new Spinwriter letter-quality printer is the only one plug-compatible with the IBM Personal Computer. So you get the business applications you've been wishing for; letter-quality output for word and data processing, multi-language, scientific, and technical printing. Simple forms handling. Quiet operation. And the reliabilty of the industry's most popular printer range.

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made for each other

WHICH SPREADSHEET?

method of usage is unclear, there is an excellent 'Help' facility available. Basically the list of command names has its own cursor, which can be shifted along by pushing the space bar. Commands can be selected by moving the command-cursor then pushing 'Return' (or by just typing the command's first letter — much quicker). However, if '?' is hit instead of 'Return' the spreadsheet screen is replaced with a 'help' screen for the currently indicated command. Moreover the information is not just a few cryptic instructions, but a fairly comprehensive run-down which in some instances extends to several pages. By the way, all the help-screen information is read from disk when needed, and does not affect the precious memory allocation for the spreadsheet itself.

To get some idea of the command facilities available, here is a quick run-down of all 20:

* Alpha. Enables text to be entered at the current cursor position.
* Blank. Blanks out one or more cells. Contents are blanked out, but display format assigned to cell is unchanged. Not the same as Delete since, in particular, the following rows or columns are not shifted.
* Copy. Copies cells from one place to another (ie, replication). Relative-copy is not possible (see text above) — must do absolute copy of relative formula!
* Delete. Deletes a row or column of cells, moving all subsequent rows/columns back by one.
* Edit. Instead of correcting a long formula by retyping from scratch, this command can be used to apply the changes quickly.
* Format. Numerous different display formats are possible: different column widths, centre, left, right justify, scientific, integer, financial, primitive bar graph, and more besides! As an extra convenience, a default format can be specified, assigning the format you most expect to use to all cells not explicitly reformatted to something else.
* Goto. Go to cell specified by its name or coordinates.
* Help. Gives general help information, not covered by the help-screens, for each specific command.
* Insert. Inserts a blank row or column, moving all subsequent rows/columns along by one.
* Lock. Locks or unlocks specified cells. Can permanently lock all formulae — useful for turnkey systems.
* Move. Moves a row or column to between two other row/columns.
* Name. Enables a cell or group of cells to be given a user-supplied name. This name can be used in formulae, and also by the 'Goto' command. It saves confusion if the name here is the same as the visible title. It saves confusion if the name here is the same as the visible title.
* Options. Used to set basic operational features, eg, switch off auto-recalculation or audible error beeps. The former is very useful when the spreadsheet is getting fairly full and every change takes several seconds — not to be registered on the screen, but for its effects to permeate through the system. The latter is absolutely priceless if you work at home and your family 'can't stand that incessant cheeping' (to quote my good lady).
* Print. Can print to printer or disk file. Option to print the formulae as well as the calculated values. This is useful for documenting or debugging the model. It's also possible to print selected areas.
* Quit. Finish — back to resident operating system (eg, CP/M, MS-DOS, etc).
* Sort. Sorts calculated or entered numbers or text by suitably shuffling rows.
* Transfer. Load, save, delete and other disk file operations. Of particular note: Multiplan can read Visicalc data files, or read/write files in a well-documented external interchange format, as well as using its own internal disk format. As it can also print to disk, it is extremely versatile in its file-handling.
* Value. Can optionally be used for entering formulae or numbers.
* Window. Split screen facility.
* eXternal. Used to read in answers calcuated by one spreadsheet as raw input data for another. Can be used for 'consolidation'.

Documentation

The documentation is comprehensive, clear and well-written. The bulk of it is in a stout ring-bound manual (minor niggle — the rings are not circular and tend to snag the pages when you are turning them quickly). It has obviously been put together with the sort of thoroughness we would expect from Microsoft, right from the Contents page at the front to the Index at the back. The basic material provided is:

* System-specific instructions. How to create your working disks under your particular operating system.
* Tutorial. Organised as seven lessons. Gives you key by key instructions, starting with simple cursor moves in lesson one through to multiple work-sheets at the end. Well illustrated.
* Reference. In alphabetical order, everything you need to know about the command, key-strokes and formula-functions. Also includes a list of all system messages, together with advice on what to do when you encounter them.
* Appendices. Extra helpful information, including a glossary and notes for Visicalc experts — a nice touch!
* Quick Reference Guide. A separate pocket book (16 pages), being a condensation of the reference section in the main manual.
* Help Screens. Comprehensive instructions on-screen for every command and a few of the other facilities.

With this breadth of documentation, there should be something to please all levels of user. Complete beginners can try the tutorial. Experts will probably just use the quick reference guide or help-screens and everyone can make good use of the comprehensive index.

Sirius slip-up

Having given the Apple version a thorough work-over, I arranged a joyride on somebody else's Sirius. The article was nearly complete

Benchmarks and other measurements

These tests were run on an Apple II system with 64k of RAM (which is in fact mandatory) and an 80-column display card (which is optional). Available space for the spreadsheet itself amounted to 21k. Figures are also included for the Sirius (with 128k of RAM, and theoretically extendable to 800k+), running MS-DOS and allowing greater storage space for the spreadsheet. Where the Sirius figures are different they are appended in parentheses after the Apple figures.

Spreadsheet size: 63 columns wide by 255 rows.
Numeric precision: 14 digits.
Max column width: 32 characters.

The benchmark tests are described in 'Which Spreadsheet' *APC* April 1983.
Benchmark 1: (a) max rows accommodated: 95(235); (b) recalculation time: 60(55) seconds — ie, 1.5(4) rows per second; (c) recalculation time: 60(55) seconds; (d) vertical scrolling: 6(6) rows per second; horizontal scrolling: 4(4) columns per second.
Benchmarks 2: max rows of text accommodated: 190 (Sirius not tested).
Benchmark 3: max rows of numbers accommodated: 190 (Sirius not tested).
Price: Around $395
Further information: Wiser Microsoft, Unit 8, 21 Tepke Road, Terry Hills 2087.

— I just needed to pencil in the Sirius Benchmark times and then off to the editor.

First problem: Sirius version of Multiplan manual temporarily mislaid. Well, I should know the system well enough by now. So, in preparation for Benchmark 1, I quickly set up the first 12 columns by 200 rows of the spreadsheet. (Readers familiar with the benchtests will know that this results in a display of 1. .12 in the first row, 13. .24 in the second, etc.)

Next I needed to set up column 13, each cell in it being the sum of the previous 12 in the row. Easy! Just use the row-sum function in column 13 of row 1, and then copy it down to all cells below it. Unfortunately I couldn't remember the correct syntax for using it. Anyway, after experimentation I found that 'SUM(C1:C12)' at least did not give a formula error message, but it did seem to be displaying the wrong answer. Okay — time to copy it. Well, much disk-whirring and clanking, then watch the calculation count-down on the VDU display. 45 minutes later; I'm still waiting and the disk is still whirring and clanking and countdown's still not finished — I'm frightened to switch off in case I corrupt the disk (it's not mine, anyway) — can't stop it at the keyboard, etc. Anyway it took about 50 frustrating minutes.

So, what went wrong? Well, basically a minor slip-up in my use of the SUM formula. I eventually got it right (by using a help-screen, what else?): 'SUM(RC[-12]:RC[-1]', and the whole test was over in under a minute. The formula I had originally used did not add the row up, but calculated the whole 12x200 array of numbers, and of course this formula was then copied 200 times down the column — a bit of a hefty number-crunch!

Anyway, the moral of this story is: make a good effort to learn Multiplan's cell-referencing — it could save you a long wait!

Conclusion

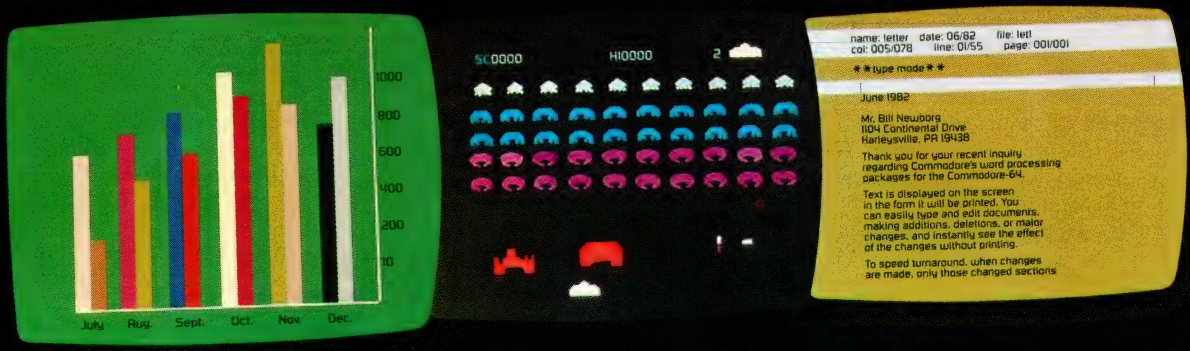
We have taken a fairly fast swoop right through the major facilities and features of Multiplan; so fast that some very valuable features, not generally available in mere state-of-the-art spreadsheet systems, may have gone unnoticed. Just for the record, Multiplan gives you:

* Sorting. If you need to sort columns of figures or text then it is impossible to do this without a 'Sort' command.
* Multiple worksheets. Results from one worksheet can be communicated to another, useful for consolidation.
* Multiple split-screens. Very flexible facility to design VDU screen display of spreadsheet.
* Flexible file handling. In particular data interchange with other software is feasible, and Visicalc data files can be read (but not written! — no doubt Microsoft doesn't want to encourage users to migrate that way!).
* Available on 16-bit microprocessor (8088/6). The new 16-bit processors can handle a lot more memory, and spreadsheet systems which have been properly installed on them can use this extra memory for setting up bigger spreadsheets (see Benchmarks).
* Comprehensive help-screens. In addition to these, Multiplan also provides more mundane, but by no means universally available, facilities — such as cell references by names, formula protection, formula printout, print to disk and formula editing.

Certainly Multiplan has a lot of facilities to offer, but what is it like to use? Well some minor complaints here: the row/column numbering scheme increases the amount of typing for formulae. You have to consider replication consequences when you enter a formula, rather than when you do the replication. you have to choose the 'Alpha' command before you enter text (okay, it's only one extra character, but most other spreadsheet systems don't do it this way). To balance these minor grumbles are comprehensive error messages, and understandable prompts for all input.

So finally, my advice to spreadsheetless owners of Apples, CP/M or MS-DOS systems, or to anyone looking for an upgrade: put it near the top of your list!

THIS IS THE COMMODORE 64 ONLY $699.



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–SHEARSON/AMERICAN EXPRESS

They're speaking to a group as interested as anyone else in the future of computers: the people who buy stock in the companies that make computers.

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MIGHT MAKES RIGHT.

The value of a computer is determined by what it can do. What it can do is largely determined by its memory.

The Commodore 64's basic RAM is 64K. This amount of power is unusual enough in a micro at any price.

At $699, it is astonishing.

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Compared with anything less, it's even more impressive.

And it can effectively double your computer-equipped work force.

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Because the basic cost of the 64 is so low, you can afford more peripherals for it. Like disk drives, printers or even printer-plotters.

This means you can own the 64, disk drive and printer for a little more than an Apple II+ computer alone.

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The Commodore 64 will have a broad range of custom software packages including an electronic spreadsheet; business graphics (including printout); a user-definable diary/calendar; word processor; mailing lists, and more.

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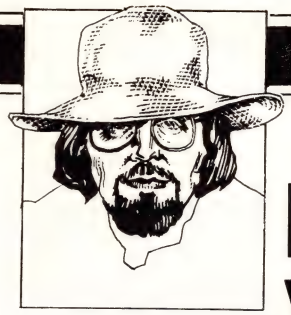


BANKS' STATEMENT

HIGH TECHNOLOGY? WE ARE NOT IMPRESSED

Martin muses on office automation, and considers eggs, baskets and Bedouins.

I have a theory. I don't for one second suppose that it is truly original, but I would claim to be the first person that I know of to have written it down, in a book I once produced.

The theory goes along the following lines: people will not accept any new development, technology or product which they can see no immediate use for or benefit from. This will be despite the fact that other people (especially the people who have developed and/or are selling the product) can see perfectly well the advantages to be gained.

A good example of this theory in action is viewdata. For those that are used to computers and computing, the use and manipulation of information and the need to gain access to vast amounts of it quickly and easily, the potential advantages of the technology are immediately apparent.

Disregarding any arguments about the specific technical capabilities of videotext as available in this country, it has been seen that marketing it purely as a 'product' has not worked. The majority of the general public — who were expected to jump at the chance of acquiring and using this new technological wonder — have however barely risen above their normal somnolent state to give it a cursory inspection and a judgement of 'Uh?'.

They have, in practice, seen little point in having vast gobs of 'information' available for which they could see no immediate or specific purpose. Only if they find an application specific to their own requirements, and only if the product — in this example videotext — solves that applications problem, will the product as a whole then be investigated.

The same can be said of personal computers — or more specifically personal computers for use in business, commerce and the professions. I have used before the phrase that the industry has been 'bought from' rather than having to 'sell to' the marketplace, and this situation is probably about to change. In the market sector relating to business and the professions, and especially those professionals that work within large company structures, the 'selling to' is now starting, and there are some suggestions that it will not be as easy for the manufacturers of personal computers to break into this business as it has been for them to create from nothing the personal computer market *per se*.

At first sight this may appear somewhat odd; for the personal computer has already proved to be a big hit in the small business sector and the professions. Certainly it is true that the majority of purchasers have had either a clear idea, or reasonable grounds to suspect they had an idea, of what they wanted to achieve. They were the users who were 'buying from' the industry.

There are many, many more users of the 'small business' type yet to move towards the computer, and that total is but a fleabite to the potential sales that exist within the walls of the large companies — the multinationals and their kin. This is the market that needs to be 'sold to'.

The majority of users, either individually or collectively, do not 'know' what they want. Oh sure, they want a computer system that will help them with their job, if only they can actually work out what it is that they do. They also, perhaps, want one for status reasons. They have trouble, however, actually identifying what it is the computer will be doing for them. Though they would possibly like one, they are not sure that they need it, or why.

Most of the rest just won't want one. They will see a computer as a threat, or as a status machine that has no relevance to them. There will be only a few (no doubt the pre-converted that have bought the likes of a Sinclair or VIC) who will positively want one of these new-fangled thingies.

For many large companies it will be worse, for they have a need to maintain, above all, some coherence in their corporate structure. Adding a new technology into the workings of the administration, financial control and product development areas of a company is a subject they will see as needing to be tackled *very* slowly.

Some estimates suggest that it could be 20 years before what we in the industry blithely refer to as 'office automation' is a normal and accepted part of a company's organisational structure.

And 20 years is a long time for some companies that are happily pinning their colours to the office automation mast to wait for their ship to come in.

There is a question here, one that goes roughly along the lines of '20 years?'. The reason the answer could be 'yes' is in the theory at the beginning of this piece. Office automation is concept built on almost infinite variation of physical implementation, and it could be many years before clear, coherent and provably workable approaches to its implementation are developed. At present, nobody really wants office automation. They have nothing against it, they just don't understand it and therefore they see no real need to have it around.

The trouble is that many of the basic tools of office automation now exist and are being actively sold to customers. In certain applications they are already successful, particularly in the small business area where one computer is now sufficient to perform the majority of tasks required by a small company.

In larger companies they are also being successfully applied to defined applications such as word processing.

These are all just scratching the surface, however, for office automation in its fullest sense will require not just the tools but the infra-structure. It will also require the experience of failed automation attempts to provide the true definition of how, where and why it should be applied. At the moment, the industry is trying to sell farming equipment to a Bedouin. If he could learn that he could probably make a better living staying still and cultivating some land then he might buy all the farm equipment going. At the moment he sees no reason to stop being a nomad.

Even important elements of office automation infra-structure like local area networks fit into this picture. They are, indeed, somewhat like viewdata — everyone feels sure that they are important because they provide rapid communications facilities, but what do you communicate? How do you use the great gobs of information generated and available?

Answer these questions, and the way to apply the technology should come as a natural by-product.

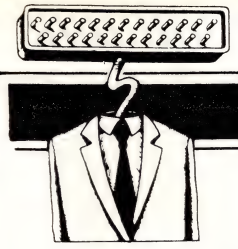
But without coherent answers, it becomes questionable as to whether any or all of the tools so far produced will have any relevance in the long term. For example, personal computers as we currently know and love them -- 8 or 16-bit boxes oriented towards individual man-machine interaction via such painful objects as the keyboard -- may prove to be entirely the wrong type of "tool" on which to base office automation. What if it proves to be something as yet undefined, like a speech I/O terminal connected optically to a processor that itself uses optical logic based on arithmetic to the base 4, derived from the four primary colours? I don't know -- maybe somebody is working on it.

What is currently true is that several companies are beginning to pin an enormous amount of faith on office automation becoming a big market, and becoming one very soon. That in itself is a considerable act of faith, but it could be seen as being compounded by another, that their products are the right ones for such a 'market'.

It has to be noted that one company in particular, Apple Computers, is aligning itself almost totally with the office automation market. Apple III and the revamped Apple IIe are office-oriented machines, and the new Lisa -- a grand, if expensive, lady of considerable talents -- greatly enhances and expands the company's product capability in that area.

It has, however, put a lot of expensive eggs into one, as yet fairly intangible, basket. There are those in the industry who feel that the basket is not actually there yet -- or if it is it could prove to be the wrong shape to hold these particular eggs.

END



COMMUNICATIONS

APC welcomes correspondence from its readers but we must warn that it tends to be one way!
Address letters to: 'Communications', APC, P.O. Box 298, Clayton, Vic 3168.

FOR THE NEXT problem . . .

I have a problem with FOR. . . NEXT loops on Microsoft Basic. I know of two ways of getting a 'NEXT without FOR' error – one is not specifying a FOR before the NEXT, and another is allowing the computer to enter the loop between the FOR and the NEXT. However, I am getting this error in some third way I do not understand. It may have something to do with jumping out of other FOR. . .NEXT loops, which is supposed to be permissible.
J R Sampson

Jumping out of FOR loops is usually poor programming technique. The FOR loop is designed to repeat the execution of a block of statements a predetermined number of times. If the number of repetitions cannot be determined until the loop is executing, then you should be using a different control structure. A WHILE. . .WEND loop may be what you need. If it is not available in your dialect of Basic then it can be built out of IF and GOTO statements.

There are two reasons why jumping out of FOR loops is allowed by Basic. One is that, in the earlier Fortran DO loop, jumping out to the 'extended range' is allowed, provided you jump back in. The other is that Basic interpreters find it difficult to stop you. When you keep leaving by jumping, you clog up Basic with dead stack entries until an error is caused. Don't do it.
– Len Warner

Interface standards

I have seen references in *APC* and other journals to an RS423 interface but have not seen any detailed descriptions of how this standard works and what the various lines do.

a) How does RS423 compare with RS232C or V24?
b) Can an RS423 interface be connected to an RS232C modem or printer? Could an adapter be made?
c) Is RS423 likely to supercede RS232C?
d) Would there by any advantage in building an RS423 interface into my existing computers, neither of which have RS232C?
S C Craddock

All these standards are designed for connecting things like teletypewriters or computers to telephone company modems, but they have been used in a simplified way for connecting computer to printer or computer to computer. There is a detailed article on this subject in Byte, February 1981.

Broadly speaking, RS232C and V24 are the same, but are published by different organisations. RS423 signal levels are compatible with RS232C and V24 equipment, but RS423 is suitable for driving longer cables. RS423 is also compatible with RS422, which is much more suitable for signalling in difficult conditions.

RS449, an interface standard which uses RS422 or RS423 signal levels will one day replace V24, etc, for telecoms. Peripherals manufacturers will make their own choices.

There are line driver and receiver ICs which make either interface easy but, for a printer, a Centronics interface avoids the need for extra positive and negative supply rails.
– Len Warner

'Twisted'

I am disappointed in you and your magazine. Before reading your March issue I was under the obviously mistaken impression that your magazine was neutral and unbiased. I am referring to your disgraceful treatment of the IBM Personal Computer. I have never read such twisted facts. I know that, like others, you suffer from the misconception that IBM is some big, bad corporation picking on poor, innocent, unsuspecting companies, but it may interest you to know that the PC is now outselling the DEC Rainbow in the USA.

I also note that you dwell considerably on the *few* disadvantages of the system. whereas you totally ignore the many superb features of the system, like the superb quality display, the high resolution graphics, the 40k ROM, the fast processing speed, the maximum memory of over 500k, the keyboard which is a joy to use, and all the backing of the best computer company in the world. I believe that the views stated by Guy Kewney only show a total ignorance of the computer world. He is the 'mug' not the people who buy

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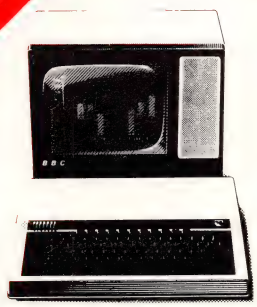

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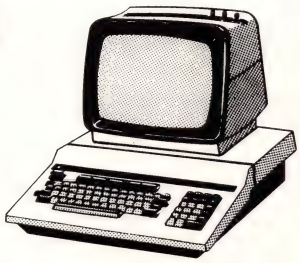

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MISSILE COMMAND, GALAGA
MONOLOPY, SCRABBLE

hardware and software from IBM.
P J Logan

Come off it Logan, there are several 16-bit machines around with higher disk capacity, high resolution graphics and nicer keyboards selling at lower prices than the PC — Ed

Standard micros?

I wholeheartedly agree with Guy Kewney's suggestion that a potential microcomputer purchaser buys what is in the shops on the day he has the money. I am surprised therefore that *APC* pays so much attention to yet-to-be-released 16 bit microcomputers and ignores so many microcomputers that can be bought off the shelf. Those microcomputers ignored include the Digital Equipment Corporation PDP-11 range of microcomputers and the Data General Micronova and Microeclipse ranges of microcomputers. I suspect that *APC* does not regard these computers as microcomputers because they were available first in minicomputer versions. However, when I look at a 40 pin Z80 CPU and a 40 pin PDP-11/23 CPU I can't see much difference.

I am a strong believer in CP/M 80 because of the wealth of software available under it. I am a strong believer in the PDP-11 operating systems RSX-11 and RT-11 for exactly the same reason. Is so much software available for any other family of 16 bit microprocessors?

So far as not-yet-available microprocessors are concerned the ones that interest me are Digital's 16/32 bit microprocessor, the J11, and National Cash Register's 32 bit microprocessor. Both are about as powerful as the Motorola 68000 and the National Semiconductor 16032 but have a great deal more software available for them. The NCR microprocessor is particularly interesting because it offers both the NCR and IBM 370 mainframe instruction sets. Perhaps someday IBM's menu driven Small Systems Executive for the 370 will be as popular for desk top micros as CP/M 80.
Paul Mayoh

Undocumented 'Bee

Firstly congratulations on a fine magazine. I wait for it eagerly each month. Having said that I will relate my problem.

My problem is in regard to my MICROBEE Computer which is a 32K plus system fitted with the EDITOR ASSEMBLER ROM. Herein lies my problem. It is the lack of written support. There is no reference to some of the most commonly used routines within the Basic Roms e.g. where does the clear screen routine lie, where does the in/out routines for the RS232 Port Lie and how does one control it from machine code, how does one gain access to the programmable character generator from M.C. I feel a document such as the Level II Rom Reference Manual" for the TRS-80 would be a great aid to the machine code programmer and would be a big plus for applied technology.

I have phoned both the Gosford and Waitara offices with much the same answer from both quarters – we don't intend to publish such an article at this time as the Basic is copy righted.

I feel, and not only my opinion but the opinion of others I have spoken to, that if a company is going to produce a product and charge money for it I think there should be documentation to support it.

I would like to hear a reply from Applied Technology regarding this matter.

Don't get me wrong – I like my BEE but not my Editor Assembler.
N G Partridge.

Offbeat functions

John Evans' method for providing in the inverse trig functions lacking in most dialects of Basic (*Communications,* April), struck me as being far too slow for any serious application (least of all tracking satellites!). Simple application of Pythagoras' theorem quickly provides formulae for arc cos and arc sine, and the slightly more esoteric functions of arc secant and arc consecant are all derived from the arc tan function provided on virtually every version of Basic. These can easily be incorporated into a program using the following function definitions:

```
DEF FNACOS(X) =
ATN(SQR(1/X/X-1))
DEF FNASIN(X) =
ATN(X/SQR(1-X*X))
DEF FNASEC(X) =
ATN(SQR(X*X-1))
DEF FNACOSEC(X) =
ATN(1/SQR(X*X-1))
```

These function definitions are only valid for valid values of X, ie:
Arccos: 0<X<=1
Arcsin: 0<=X<1
Arcsec: X>=1
Arccosec: X>1

MICROBEE

THE FOLLOWING PROGRAMMES ARE NOW AVAILABLE FROM MYTEK COMPUTING

MACHINE CODE TUTORIAL consists of eight interactive exercises designed for teaching machine code programming and related topics as they apply to the MicroBee computer. Only a general knowledge of the BASIC language is assumed. MACHINE CODE TUTORIAL is designed to bridge the gap between BASIC programming and being able to understand and use typical Z80 manuals.

MACHINE CODE TUTORIAL uses a unique double screen technique to display both the normal computer output and the tutorial on the screen at one time. This allows the student to use the MicroBee in the normal way, while the tutorial instructions appear in the lower half of the screen.

A Monitor is built into MACHINE CODE TUTORIAL

Topics covered include the following:

- Using the in-built Monitor: DUMP, ENTER, GO MOVE
- Writing and Running Z80 Machine Code Programs
- Nearly all Z80 Mnemonics
- Flags
- Hexidecimal-Decimal-Binary Conversion
- Assembly Language and Hand Coding
- Using the BASIC USR(x) Statement
- Instream and Outstream Vectors
- Screen RAM
- Cursor Control
- PCG and Programming Graphics Shapes
- Memory Map Explained
- ROM Read Latch
- BASIC Scratch Area
- 6545 Video Driver Chip Explained
- RESET Options
- Special GO addresses in the BASIC Language
- Z80 Speeds and Timing
- Undocumented Secret Z80 Codes
- Keyboard Scanning. Checking for More Than One Key Depressed
- Parallel and Serial Interfacing
- Cassette Interface and Associated Subjects
- Sound Effects Generation
- Format of BASIC Programs in Memory
- Speech Digitizing

BASIC TUTORIAL is a super teaching aid for any classroom. BASIC TUTORIAL is a set of nine interactive exercises designed for teaching Basic to the computer novice. No previous knowledge is assumed.

BASIC TUTORIAL uses a unique double screen technique to display both the normal computer output and the tutorial exercises at the one time. This allows the student to use the MicroBee in the normal way, while the tutorial instructions appear in the lower half of the screen.

To learn to drive a car, a student must get in and drive. Reading theory books help, but the real learning comes by driving. The same applies to computing. Books are no substitute for experience. These computer run tutorial exercises teach computing better than any other form of instruction.

DIGITALKER is a Computer Voice Storage & Retrieval System. Give your MicroBee a Voice! DIGITALKER allows the MicroBee user to store his voice in the computer as digital data which may be played back at some later time.

Simply load the DIGITALKER software, plug the DIGITALKER hardware into the I/O PORT and connect the DIGITALKER lead to the EAR plug of your tape recorder.

Once the voice has been recorded, it may be played back immediately or stored on cassette. The digitized voice may easily be incorporated into the users own programs without detailed knowledge of machine code. The DIGITALKER hardware is not required in order to play back the voice. Thus any MicroBee user may play back a voice previously recorded with DIGITALKER!

★ A Monitor program is included with DIGITALKER ★

ASTEROIDS PLUS is the finest high resolution graphic arcade game available for the MicroBee computer. It features spinning 3-D point by point resolution graphics, shields, intelligent beings, guided missiles, black holes, high-score board and breathtaking sound effects. ASTEROIDS PLUS took more than 1,000 man hours to write and cost in excess of $20,000 to develop. You owe it to yourself to experience the best in arcade games on your MicroBee.

TOUCH-TYPE TUTOR employs one of the worlds most advanced methods of learning to touch-type. Most computer users are one-finger typists. As well as typing slowly, they contract eye strain by having to keep glancing between the keyboard and screen. TOUCH-TYPE-TUTOR quickly teaches the student to type without looking at the keyboard with a unique method of combining sight and sound. TOUCH-TYPE-TUTOR gives graded exercises and displays a keyboard on the screen. It also lights up the next key, flashes and beeps if any error is made and gives an accuracy rating. As well as all this, the words-per-minute rate is displayed and if the student does well, the MicroBee will actually compliment him in a human voice!

BEEZ80 is far from your average run-of-the-mill disassembler! Other than being a mere 4K long, able to disassemble at the speed of light and packed with options, BEEZ80 will display before your very eyes all those unknown instructions ZILOG never talk about! The author has been doing extensive research into the actions of the Z80 processor when confronted with the 700 or so undocumented (and so called "illegal") code sequences. Over 100 of these are VERY useful! Did you know you have extra 8 bit registers and a complete set of instructions to manipulate them? Did you know about extra rotate instructions?

MYTEK MONITOR provides the user with a System Level Interface which is a must for any application outside BASIC programming. A Monitor allows the user to display and change memory contents, move memory contents, save the load specified areas of memory to and from cassette, as well as fill, search and compare memory. MYTEK MONITOR loads into normally unused memory locations F400 through F7FF. Thus no valuable program space is used.

The following Monitor commands are available: Parameters enclosed in [square brackets] are optional.

DU xxxx [yyyy]	Dump memory onto the screen from xxxx to yyyy. Parameter yyyy is optional	LO [xxxx]	Load file from tape. If xxxx is specified, the file will start loading from this address rather than the header address
DA xxxx [yyyy]	Dump memory onto the screen and also print the ASCII characters	FI xxxx yyyy [zz]	Fill memory from location xxxx to yyyy with the byte zz (default 00)
EN xxxx	Enter or change memory locations starting at xxxx. Type HEX bytes separated by a SPACE or RETURN. Terminate with back slash /	MO xxxx yyyy zzzz	Move memory block xxxx-yyyy to the block starting at location zzzz
AS xxxx	Enter ASCII text. Type RETURN at the end of the line to continue. Terminate with a backslash /	CO xxxx yyyy zzzz	Compare block starting at xxxx with block starting at yyyy for zzzz bytes. Any differing bytes are displayed
GO xxxx	Execute the Z80 program starting at xxxx. The monitor WARM start is pushed onto the stack	SA [F] namexx T xxxx yyyy [zzzz]	Save block xxxx-yyyy on cassette with optional auto EXEC address zzzz. Optional F specifies 1200 baud, default 300. The NAME may be 6 characters long and the file type T may be any ASCII character
BA	Jump to BASIC. To re-enter the monitor, give the BASIC command EXEC or hit RESET	SE xxxx yyyy aa [bb cc dd ...]	Search from xxxx to yyyy for occurance of bytes aa bb, cc etc

WORDPROCESSOR. This full and comprehensive professional Wordprocessor comes in a quality ring binder and features most of the commands of the highly acclaimed SPELLBINDER. We expect to release this package by late June 1983, at a retail price of $40 to $50. Ring or write for details.

All **MYTEK** programs come on cassette, are written in machine code and run on both 16K and 32K MicroBees. We are able to take phone orders. Programs to be released in the near future are: WORDPROCESSOR, DEFENDER Game, Cassette Based Z80 EDITOR/ASSEMBLER Package, Microsoft Compatable 8K BASIC INTERPRETER, Microsoft Compatable Cassette Based COMPILER, and TAPE DOCTOR.

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WANTED: We wish to contact programmers who are capable of producing high quality software in any area of programming on the MicroBee. MYTEK is the largest independent producers of software for the MicroBee and if you wish to join our team of skilled programmers, please phone or write to us.

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Note that any argument that would give an angle of $\pi/2$ gives a divide by zero error, and these cases should be checked for.
Nick Osborne

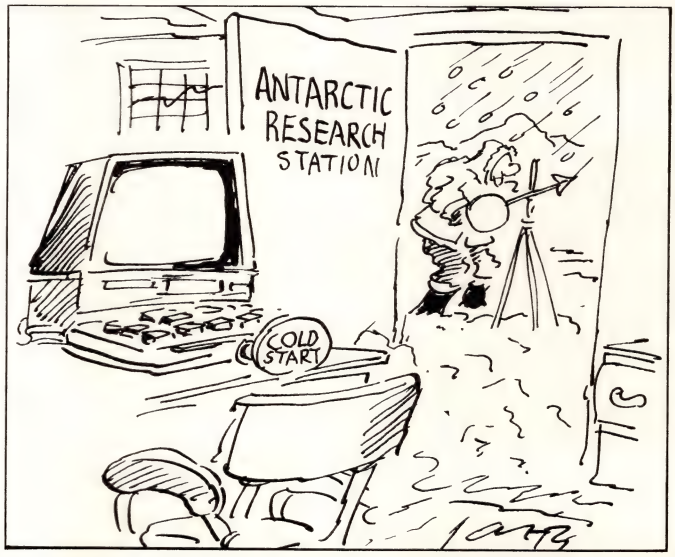
Personal preferences

Does Roger Cooper (Communications, March 1983) express dates in the format 1983 Feb 23rd or Feb 23rd 1983? If his reasoning is consistent we should use the former, but I shall stick to day – month – year (and a watch with hands), thanks all the same. In the light of this discussion, it is interesting to see that new versions of MS-DOS will provide a system call that tells a program how to format the date to suit local practice.

Turning to another subject, if John Beutel likes Fortran, he might find Ratfor (Rational Fortran) even nicer. The language is described in Kernigan and Plauger's book "Software Tools" along with the design for a Ratfor to Frotran translator (feed in a Ratfor program and out comes the Fortran equivalent which you compile in the normal way).
Steve Withers

Worthy

If we had a 'Communication of the Month' it would certainly have gone to R Lees who wrote to "Wild Bills' Computer Rodeo (see last month's issue, page 52) C/- *APC* including a cheque for $853.02 (Hong Kong Dollars):
Dear Wild Bill,
Wow! Please rush me my absolutely free VZ 200 to the above address. I enclose my cheque, which you may refund if not absolutely satisfied.
Yours hopefully,
R A Lees.
Send the "above address' to the subscription manager and we'll send you a year's sub. to *APC*,
Mr Lees. To our other readers, it is rumoured that Wild Bill's now in Brazil.



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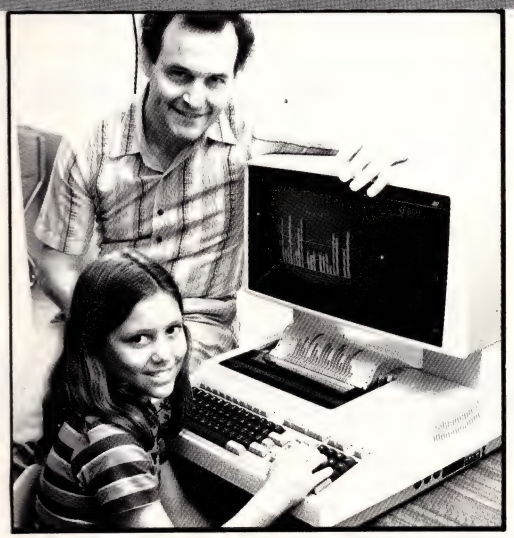

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Standard capabilities 64K RAM, 10 programmable function keys (no shift needed), Z80A processor (no extender board needed), 4MHz cycle speed, 640 x 200 dot **bit** addressable graphics, eight foreground **plus** eight background colours, full 99 station keyboard, upper/lower case, separate numeric & cursor pads, RS232, light pen, audio cassette, composite video, 40/80 columns, ROM cartridge, **and** 80 cps 80 column microline printer (fully integrated).

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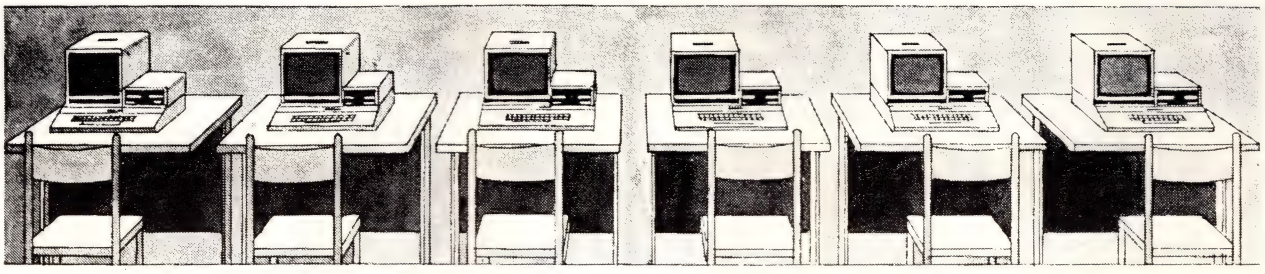
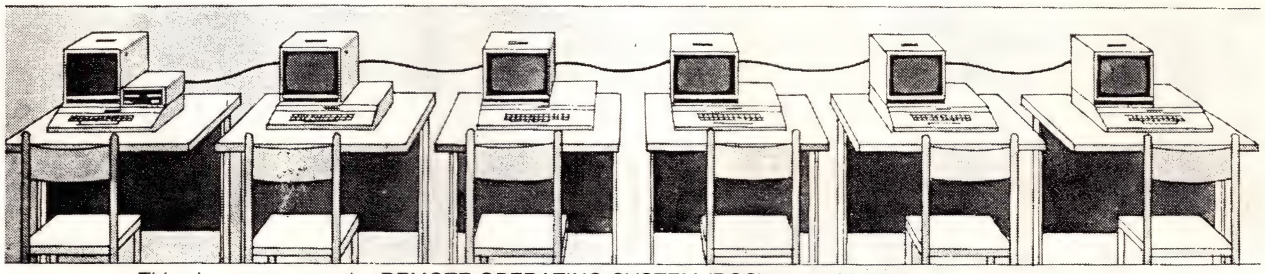


This classroom uses a separate disk drive for every Apple II.



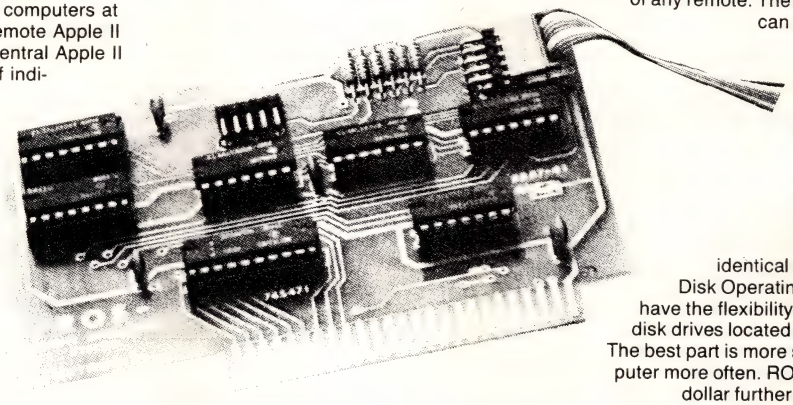
This classroom uses the REMOTE OPERATING SYSTEM (ROS) to provide disk storage for programs.

ROS IS EASIER ON THE BUDGET.

ROS replaces floppy disk drives on up to 127 independently run Apple II computers at substantially lower cost. Two remote Apple II computers can be linked to a central Apple II disk system for half the price of individual disk drives. ROS can be expanded for less than one third the cost of an additional drive. The savings on four remotes could buy another Apple II and monitor.

ROS IS EASIER ON THE EDUCATOR.

ROS simplifies instruction when using more than one Apple II. One diskett can supply all programs to the remotes instead of loading multiple copies into each separate system. ROS also allows the central computer to monitor the activity of any remote. The progress of any student can be tracked while seated at central Apple II.



ROS IS GREAT FOR STUDENTS.

Students will find ROS very simple to use. ROS allows loading and saving of Applesoft and Integer programs using identical commands as the Apple Disk Operating System. Students can have the flexibility of accessing up to eight disk drives located at the central computer. The best part is more students can use a computer more often. ROS stretches your budget dollar further to buy more computers.

Features

- Password Protection.
- 127 Remotes may be connected to Central.
- Up to 8 Floppy Disk Drives on Central.
- R.O.S. uses identical command words to Apple DOS.
- Auto start compatible for turn-key system start up.
- Special R.O.S. "FEED" command for simultaneous loading a program.
- Special "WAIT" message tells the remote user when the network is busy.
- Special "HELP" command provides user assistance.
- Special error messages clarify network operation.
- Complete listing of valid network commands displayed on remote at start up.
  - LOAD program name, disk drive letter
  - SAVE program name, disk drive letter
  - VERIFY program name, disk drive letter
  - RUN program name, disk drive letter
  - INT (change to integer language)
  - FP (change to floating point language)
  - CATALOG, disk drive letter
  - KAT (special command) = quick reprint of last catalog
  - HELP (special command) = explanation of R.O.S. commands
  - FEED (special command) = receive program simultaneously
- Future expansion of system capabilities through software only.
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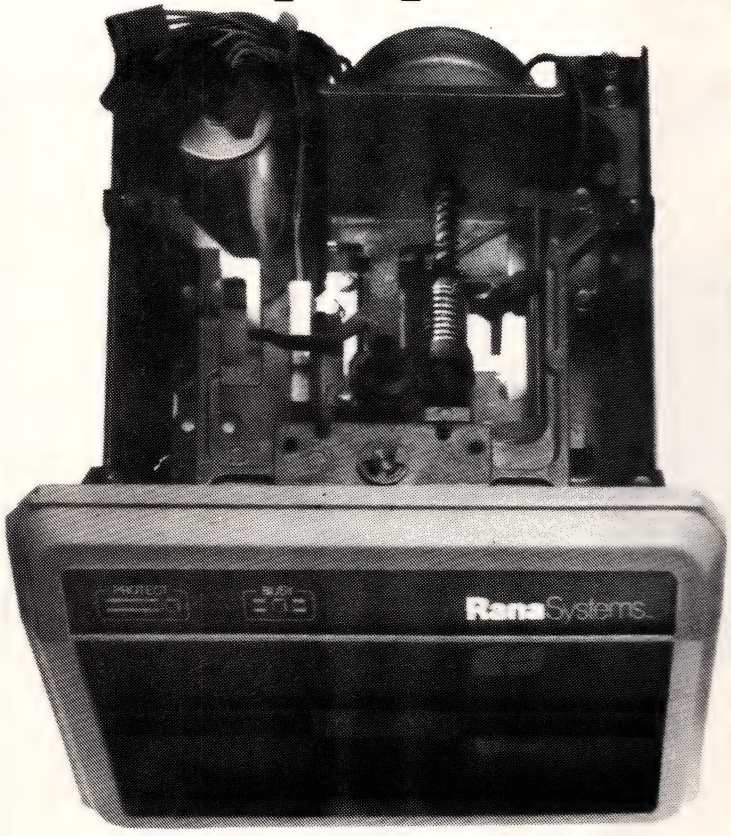
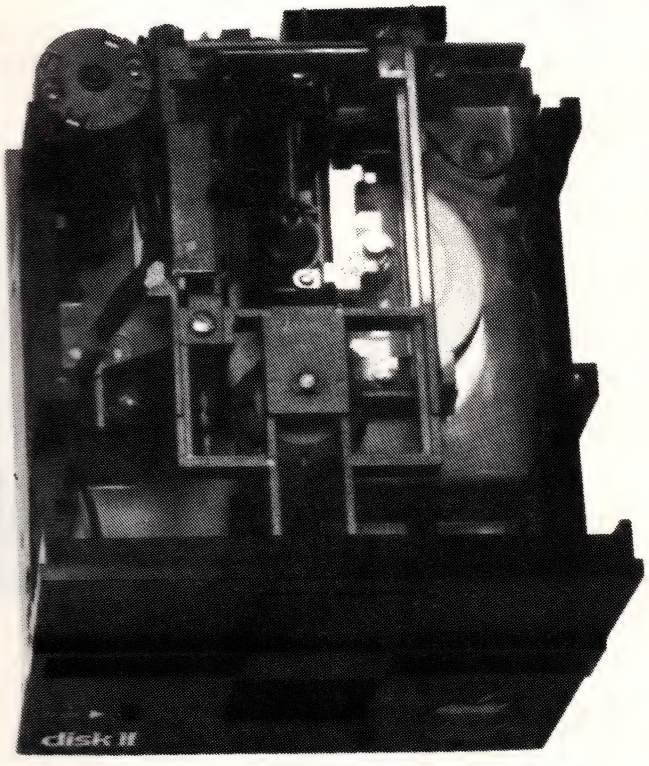
When you say your disk drive has more juice than Apple's, be prepared to cut one open.





Your Apple computer can grow from ordinary to awesome in a matter of minutes.

The Elite disk drive series by Rana Systems gives you that kind of magic. Quickly, easily and cost-effectively.

This superb family of sophisticated floppy drives was designed and perfected by a team of industry-respected engineers expressly for Apple computer owners who have long been demanding more disk drive for their money.

Now they *have* a drive that makes an Apple perform the way it should. For example:

Elite One, the most economical Rana drive, delivers 15% more storage capacity than Apple's drive. The top-of-the-line Elite Three will provide an astonishing *four-times* more storage, approaching hard disk performance. It's done through exclusive high-density single and double-sided disks and heads.

ELITE 1	$699	(163kb) with Controller . . .	$869
ELITE 2	$899	(326kb) with Controller . . .	$1089
ELITE 3	$1199	(652kb) with Controller . . .	$1375
Controller only	$176	All prices include Sales Tax	

All Models Available Ex-Stock

Here's a tantalising taste of just how formidable your Apple can become.

Next to enormously increased disk space, Apple buyers are most excited about Rana's fingertip Write/Protect feature. A pushbutton on the LED-lit panel gives you a new measure of failsafe control.

While Elite drives are all plug-compatible with Apple's controller, Rana's vastly superior controller card is a *must* for those with growing data processing demands. With it, you control up to *four* floppy drives using only one slot . . . while still utilising your Apple computer to achieve dramatic new heights of system flexibility and processing power.

A specially programmed Rana utility disk assures you of far-reaching compatibility, and extra dimensions of business, leisure and learning applications with your Rana-enhanced Apple computer.

There are many, many more operating refinements: Uncanny head-positioning accuracy, 300% faster track-to-track speed, better operating economy, and gentler clamping action through an all-new diskette centering cone, to name just a few.

A disk drive package like this doesn't grow on trees, so write or call today for more information about the Elite series.

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The BYTEWRITER is a new Olivetti Praxis 30 electronic typewriter with a micro-processor controlled driver added internally.

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Keyboard
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44 alphanumeric keys (100 printable characters) and 17 function keys.
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Shift lock.
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Automatic repeating return and vertical spacing.
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Tabulator setting key.
Tabulator clearing key.
Alphabetic tabulation key.
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* Machine is designed as a general purpose computer & when expanded into 64K in conjunction with dual disk drive this machine is capable of executing other language on disks.

SPECIFICATIONS:

Model	: KOMTEK I
CPU	: Z80 microprocessor at 2.0 MHZ clock
Memory	: 16K RAM with 8 sockets on board in situ expansion to 32K
Basic interpreter	: 12K standard basic I or II
Colour Interfaces Provision	: PAL-compatible. 8 Colours : Plug-in program cartridges Max. 12K
Keyboard	: Real keyboard typewriter style : Graphic pattern : Multi-function
Display	: Both monitor and home TV compatible : RF modulator built-in : High resolution graphics 256 x 192 : Graphics
Sound	: Soft-ware control : Built-in speaker
I/O facilities	: Port for serial I/O e.g. for RS232C devices. : Port for parallel I/O e.g. printer, keypad. : Audio cassette as mass storage
Time	: Real time clock

Model Configurations:

Komtek I	: as specifications with provision for conversion to colour and control functions
Options	: 64K RAM expander : Disk controller : 5.25" or 8" disk drive : Serial I/O e.g. for RS-232C devices : Alarm & automatic turning on/off appliance

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* cassette interface;
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* Australian designed autostart
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* typewriter-style ASCII keyboard;
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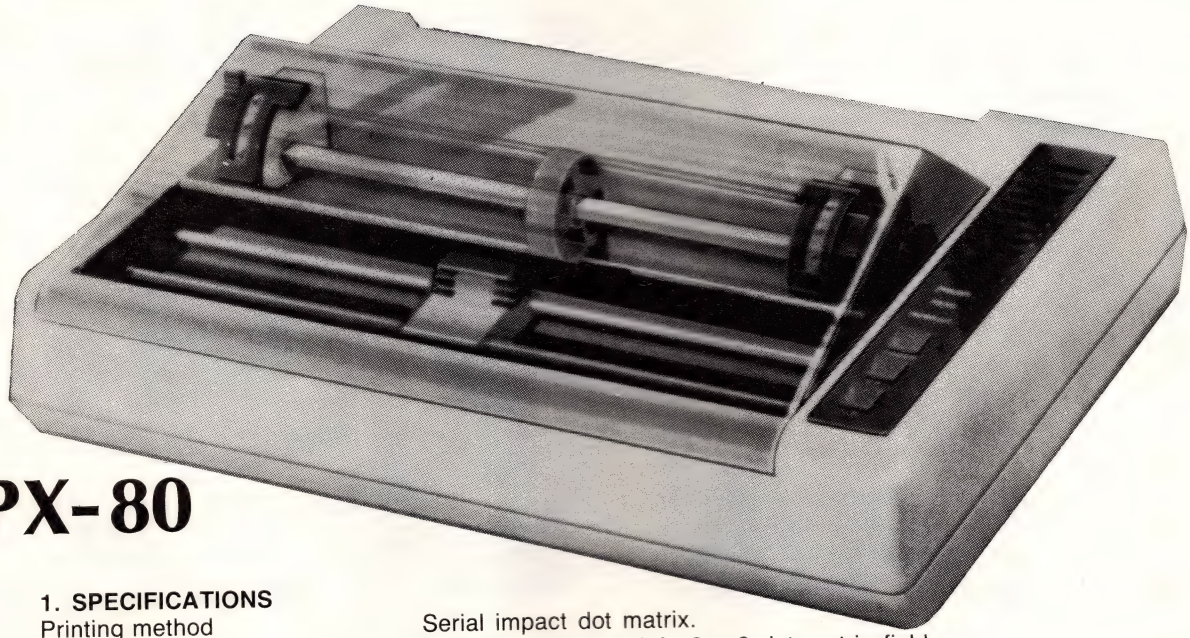

PX-80

1. SPECIFICATIONS

Printing method	Serial impact dot matrix.
Printing format	Alpha-numeric 7 x 8 in 8 x 9 dot matrix field
Character set	228 ASCII characters; Normal and italic alpha-numeric fonts, symbols and semi-graphics.
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Line feed time	Approximately 200 msec at 4.23mm (1/6″) line feed.
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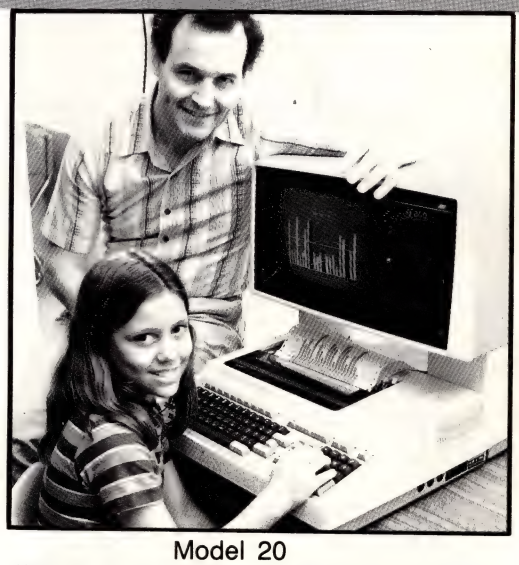

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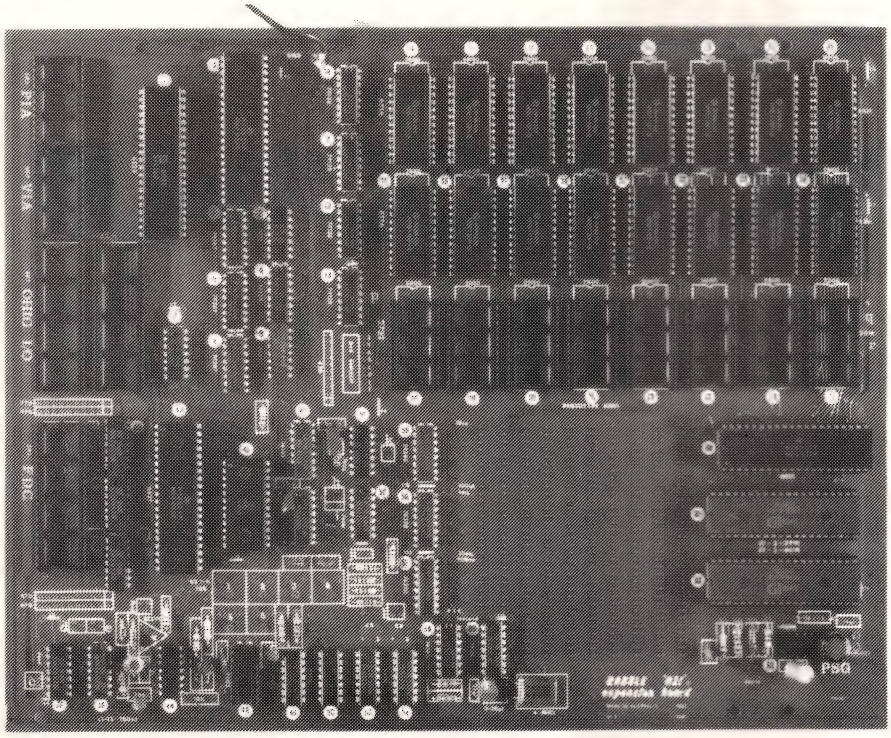

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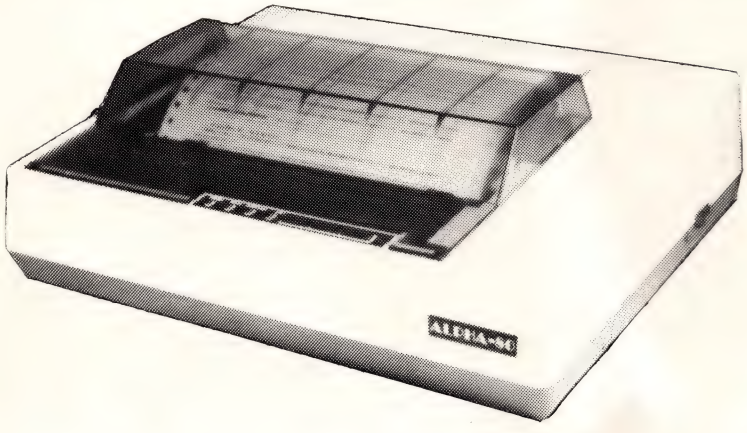

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HARD WARE

A J Simmonds details a simple Centronics interface for System 80 and TRS-80 Model micros.

CENTRONICS HOOK-UP

I have had a System 80 for a year now, but I have only just bought a printer (a Tandy Lineprinter VII with Centronics interface). I could not afford both an expansion interface and printer, so I decided to build an interface circuit to connect between the System 80 expansion interface bus and the printer's Centronics port. There are interface circuits which you can buy to do this job, but the circuit is relatively simple, so I decided to build it myself and put the money I saved towards a disk drive! The circuit can also be used by a TRS-80 Model 1.

The System 80 uses port FDH (decimal 253) for the printer, the TRS-80 Model 1 uses memory location 37E8H (decimal 14312). Normally this causes no problems for the System 80 user, but for EDTASM it is a problem since EDTASM uses its own printer driver routine (not the ROM routine) and naturally expects the printer to be at 37E8H. This was done so the EDTASM could be used with both Level 1 and Level 2 Basic. It's possible to rewrite EDTASM for the System 80; the changes necessary are to replace LDA, (37E8H) with IN A, (FDH) for the printer status check, and to replace LD(37E8H), A with OUT (FDH), A to print a character. However, a simpler way is to do it in hardware, by ORing the TRS-80 printer address decoding with the System 80 printer port address decoding. The circuit is shown in Figure 1. I suggest that first you try getting the circuit to work with the LLIST and LPRINT commands, and they try adding the circuitry for EDFTASM. For a TRS-80 Model 1 you only need the address decode circuitry as shown for EDTASM.

This circuit has been built and tested. It

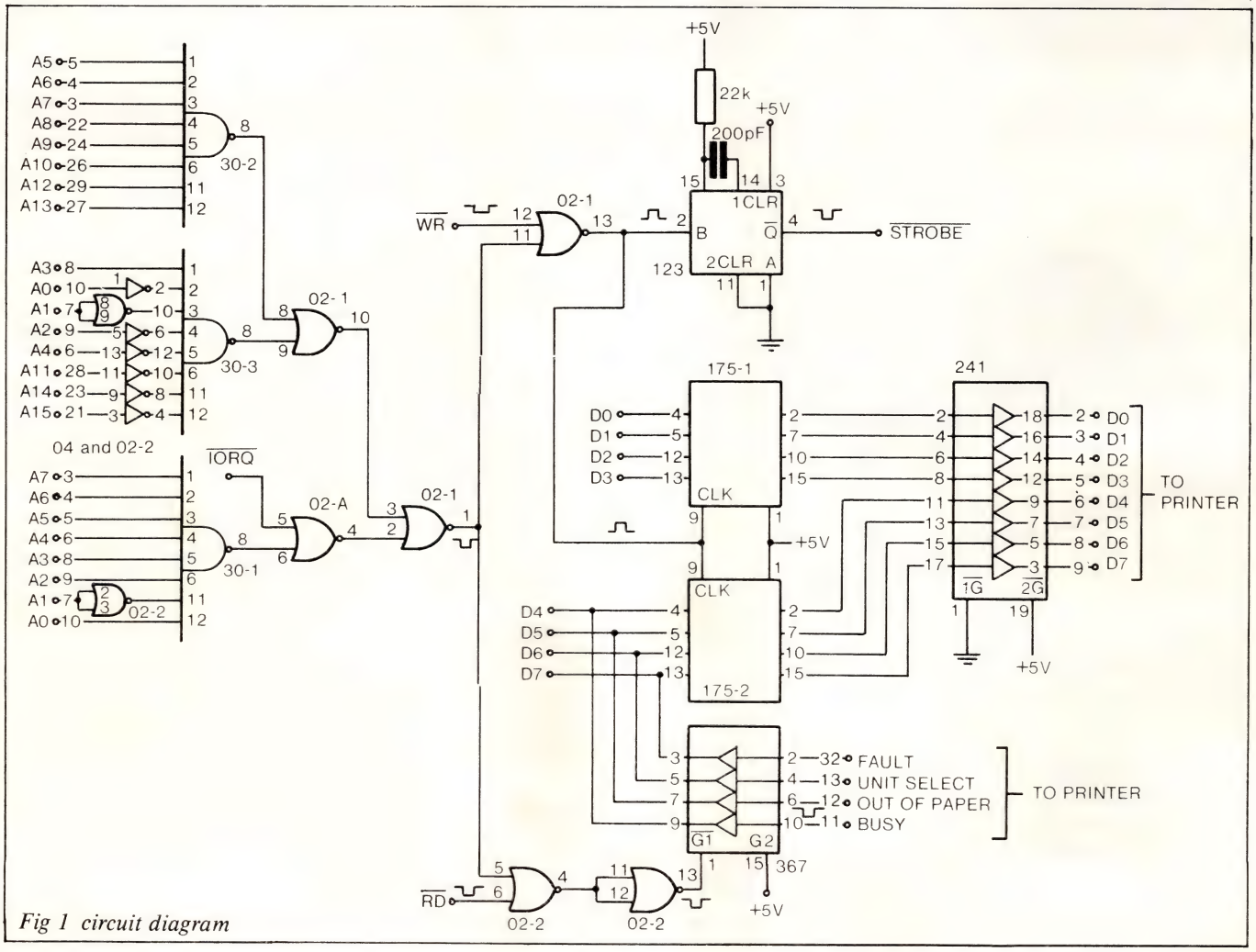


Fig 1 circuit diagram

IC	+5v	earth
04	14	7
30-1	14	7
30-2	14	7
30-3	14	7
02-1	14	7
02-2	14	7
175-1	16	8
175-2	16	8

+5v from pin 19 System 80 expansion bus.

IC	+5v	earth
123	16	8
241	20	10
367	16	8

+5v from pin 18 Centronics connector.

Fig 1 Power connections

Printer Status	Active	Centronics Pin	Lineprinter VII
Fault	low	32	high
Unit	high	13	high
Select	high		
Out of Paper			
Busy	low	11	Busy

Fig 2

worked the first time and, assuming there are no mistakes in the diagram and you check your wiring before you switch on, it should work first time for you. Just in case you do make a wiring mistake, it's best to use IC sockets.

All chips should be low power Schottky TTL (74LS series) since they are to be powered from the interface pins to save the need for a separate power supply. In Figure 1 the chips are identified by their type, e.g. 123 is a 74LS123; if there are more chips of the same type then they are numbered, e.g. 30-1 and 30-2 are both 74LS30. ICs 123, 241 and 367 should be powered from pin 18 (+5v) of the Centronics connector. All other ICs should be powered from pin 19 (Vcc) of the System 80 expansion bus. Pins 1, 2, 49 and 50 of the System 80 expansion bus and pins 19-30 and 14-17 of the Centronics connector provide the earth and should be connected together. The Lineprinter VII only provides a Busy signal for the status, hence the other status signals (Fault, Unit Select and Out of Paper) are constant voltages. The Centronics interface is designed for reasonably long connections, so I have a 2m long cable. The System 80 expansion bus on the other hand is not — I think 10 centimetres of cable is the maximum it can cope with. You will need a 36-pin AMP connector for the Centronics interface, 2m of 36 or 37-strand cable, 10cm of 50-strand cable and a 50-pin female connector for the System 80 expansion bus. To connect the 50-pin connector to the cable you will need care, a vice, and perhaps right at the end a hammer!

1	gnd	26	A10	17	D7	42	ccdbs/ stadbs
2	gnd	27	A13				
3	A7	28	A11	18	D6	43	mreq
4	A6	29	A12	19	VCC	44	dodbs/ addbs
5	A5	30	phi				
6	A4	31	pint	20	D4	45	ml
7	A1	32	nc	21	A15	46	reset
8	A3	33	nc	22	A8	47	rfsh
9	A2	34	phlda	23	A14	48	nmi
10	A0	35	phantom	24	A9	49	gnd
11	D5	36	halt	25	nc	50	gnd
12	D2	37	pwait				
13	nc	38	IORQ				
14	D1	39	phold				
15	D0	40	WR				
16	D3	41	RD				

Expansion pin edge viewed from rear side:

2 50

1 49

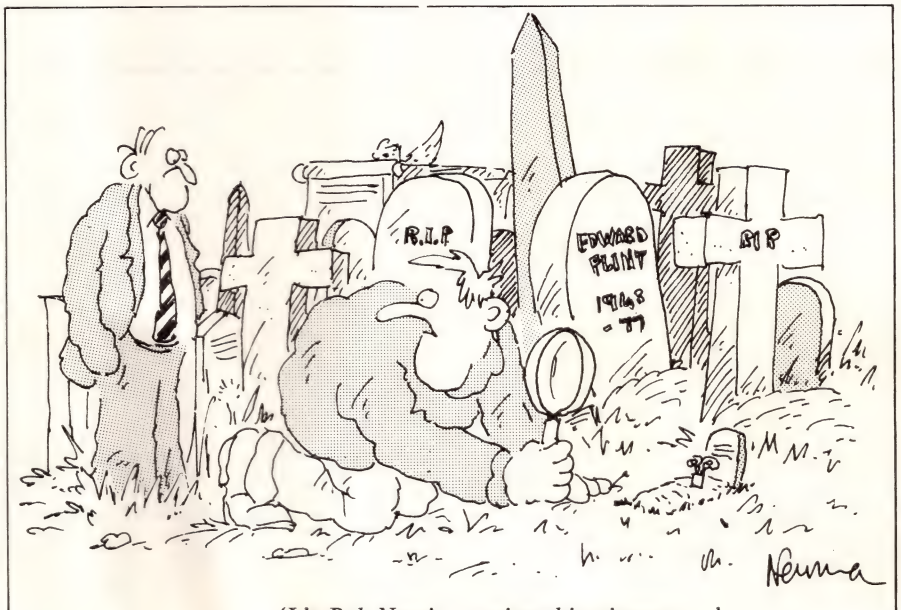
Fig 3 System 80 expansion bus.

And for the circuit description, IC 30-1 detects when port FDH is addressed (on address lines A0-A7) for a System 80 printer request. ICs 30-2 and 30-3 together detect when address 37E8H is addressed (on address lines A0-A15) for an EDTASM printer request (i.e. exactly as a TRS-80 Power Connections Model 1). IC 123 produces a longer strobe than the WR pulse; this is necessary because the Centronics interface is slower than the System 80 expansion bus (hence it can be longer). IC 175-1 and IC 175-2 hold the data byte (on D0-D7) till the printer has acknowledged (by setting Busy low) that it has received the byte. IC241 is a buffer to stop reflections on the Centronics connector from upsetting the flip-flops in IC175-1 and -2. IC367 is a tri-state buffer to gate the printer status onto the data lines (D4-D7).

Naturally other ICs could be used instead, e.g. a 74LS122 retriggerable monostable instead of the 74LS123 dual retriggerable monostables, two 74LS04s instead of the 74LS241, latches instead of the master-slave 74LS175 and so on. However, it is better to have a built and tested circuit to work from rather than someone's idea of what might work. I hope you have fun building this circuit, and even more out of using it.

1	strobe	19	gnd (pair with pin 1)
2	D0	20	gnd " 2
3	D1	21	gnd " 3
4	D2	22	gnd " 4
5	D3	23	gnd " 5
6	D4	24	gnd " 6
7	D5	25	gnd " 7
8	D6	26	gnd " 8
9	D7	27	gnd " 9
10	ack	28	gnd " 10
11	busy	29	gnd " 11
12	out of paper	30	gnd
13	unit select	31	nc
14	gnd	32	fault
15	gnd	33	nc
16	gnd	34	nc
17	gnd	35	nc
18	+5v	36	test

Fig 4 Centronics parallel connector



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"OK, OK," I whined. "Just give me 'til tomorrow morning . . ."

There was a grunt and then just the purr of a dialling tone. My hands were sweaty and it wasn't from the sweet and sour pork I'd had for lunch. I poured a shot of bourbon and rummaged for the July issue of Australian Personal Computer. There was an article on sub-routines in the January issue which might save me several hours of number-crunching. Now where was that issue?"

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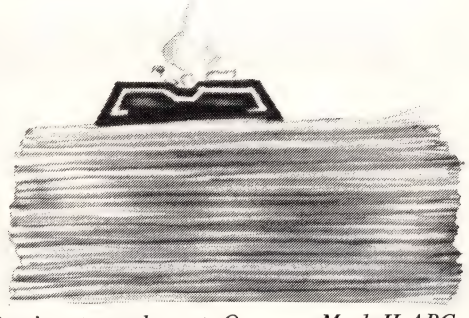

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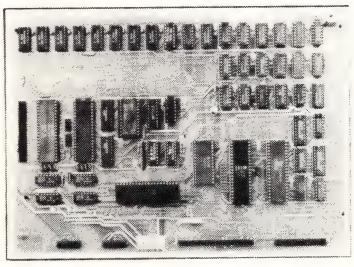

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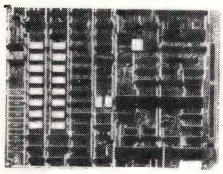

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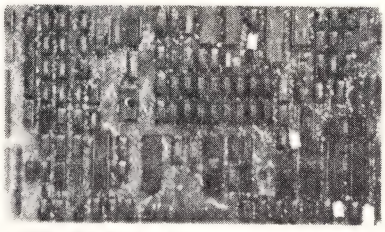

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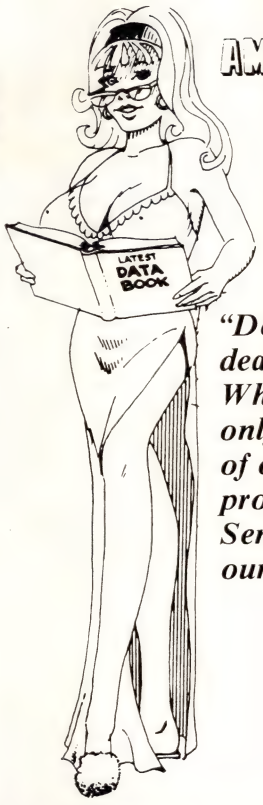

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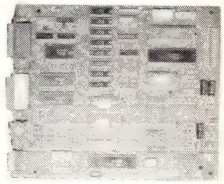

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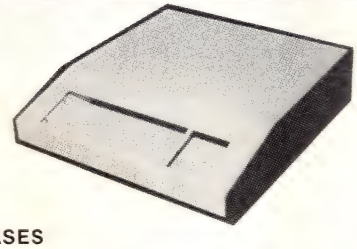

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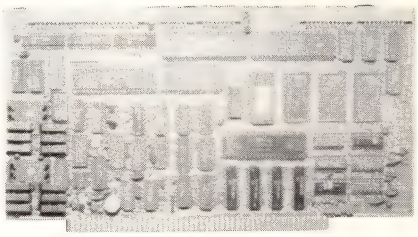

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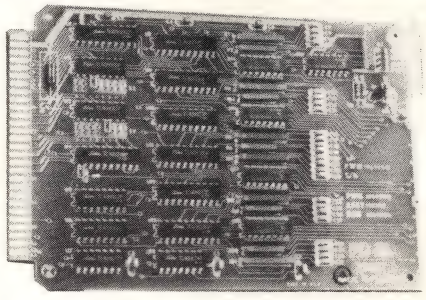

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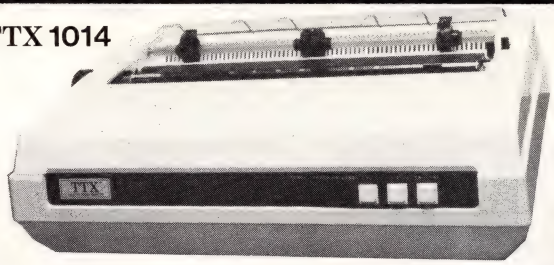

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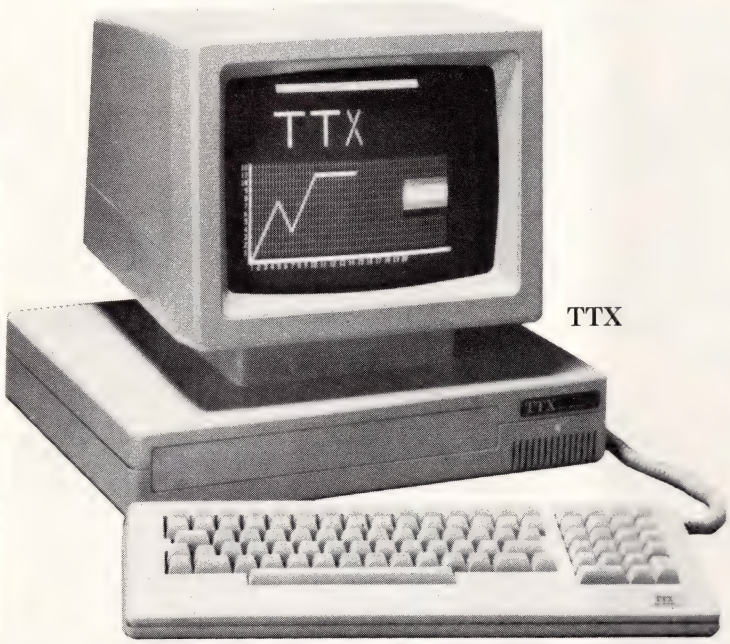

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BENCHTEST

COMMODORE 64

A home computer or a small business system? Mike Curtis looks at the latest contender to the VIC-20.

The first sight of the Commodore 64 brings an immediate sense of déjà vu; it is almost identical in appearance to the very popular VIC-20.

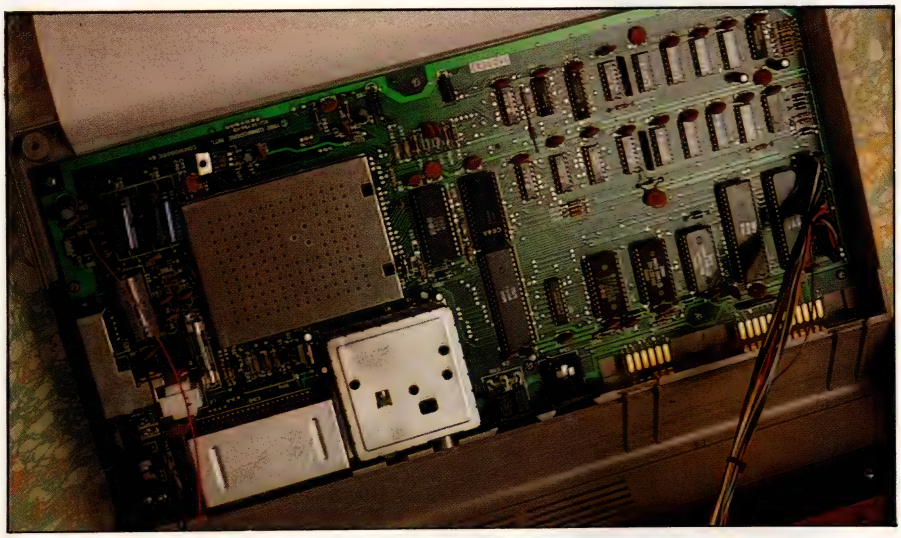
Viewed in this context the new Commodore machine would look to be a sure winner in the current race to put more and more memory into a small, home computer package. The price of $699, however, would seem to exclude competition with the Sinclair Spectrum, VZ-200 and other similar machines and pit the new Commodore against more "serious" machines, with an educational and small business market in mind.

Commodore itself sees the machine as a low-end business machine, which can be taken home at weekends and can double as a high quality home computer, rather than the opposite. It must be borne in mind though, that a large and successful company like Commodore can afford to be flexible on prices, as when it slashed the price of the VIC-20 not so long ago. In a year or two's time when the VIC has reached its limit the price of the 64 may come down.

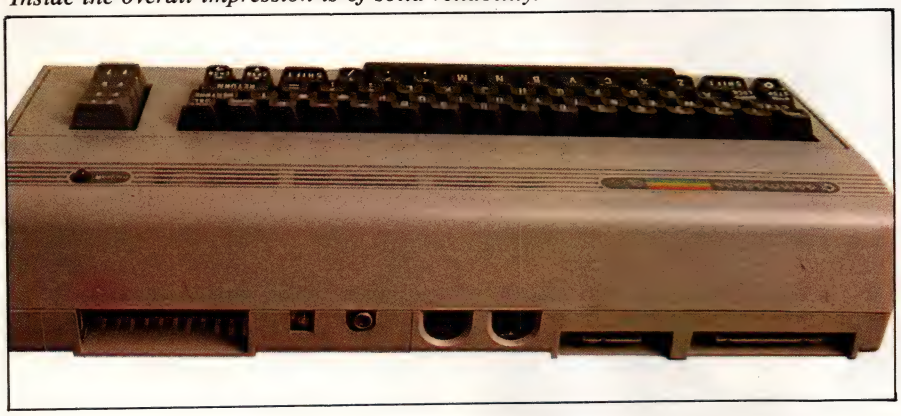
Hardware

The Commodore 64 comes in a large multicoloured box like the VIC, and when removed from its packaging material reveals itself in a light browny-grey case 16″ by 8″ and a maximum of 3″ high. Most of the top is taken up by a full size qwerty

The keyboard is laid out almost identically to that of the VIC.



Inside the overall impression is of solid reliability.



Most of the top is taken up by a full size qwerty keyboard.

keyboard. The keys are a chocolate brown colour apart from four function keys to the right of the main keyboard which are a shade lighter. This only leaves room for the Commodore 64 name at the top left and a single LED labelled "power" at the top right. The appearance is attractive and functional and clearly it is intended to blend in well with any office or home environment.

There is a separate power supply in the same type of strong plastic and the same colour as the computer.

A multitude of connectors can be found on both the right hand side and the back. On the side are the power socket next to a small on/off switch, and a pair of 9-pin sockets labelled control port 1 and control port 2 where joysticks and light-pens can be connected. At the back, reading from left to right as you look at them, are a cartridge slot, a small screw head which can be used to select the channel for the TV display, a phono-socket for the UHF TV signal, and two DIN sockets. One DIN socket carries both a composite video output to drive a monitor and an audio signal which can be plugged into a hi-fi. The other DIN socket functions as a serial port into which can be plugged a

VIC printer or a VIC disk drive. Also at the back are two edge connectors; one for the cassette interface and the other for the "user port" into which can be put various interface cartridges such as a modem or RS232. These should be familiar to any VIC or even PET user.

As usual on Commodore machines it is very easy to connect a whole range of Commodore peripherals to the 64, though other peripherals are more difficult. But it should be possible to connect, for example, a daisywheel printer via the RS232 cartridge in the user port slot. The Commodore 64 uses the same C2N cassette unit as the VIC.

Using the Commodore 64

The only thing necessary to get the Commodore 64 working is a 13 amp plug. The leads from plug to power supply and from power supply to computer are reasonably long and another long lead is provided to plug into the aerial socket of your television. The television must be tuned in to the computer's signal as usual, though this did not in my case turn out to be quite at the familiar spot of channel 36 that other machines use.

When all is working properly the screen clears to display a light blue border of about 1" surrounding a darker blue rectangle with the heading COMMODORE 64 BASIC V2 and the message that you have 38911 BASIC BYTES FREE. This to some extent makes nonsense of the claims to offer 64k of memory. Even using Assembly language the Commodore 64 can offer you only 48k of useable memory, but this is no worse than the majority of other machines; indeed it compares quite favourably with the 33080 bytes that MBasic leaves me on my 64k CP/M machine. The lettering and the cursor are in the same light blue as the border, the cursor flashes by inverting whatever is on the screen under it.

Keyboard

The keyboard is laid out almost identically to that of the VIC. At the bottom left is the Commodore key with the Commodore logo, which has several control functions; above is a key labelled RUN/STOP; there are SHIFT, SHIFT LOCK and CONTROL keys also on this side. On the right hand side are keys labelled CLR/HOME, INST/DEL and RESTORE as well as RETURN and another SHIFT; there are two cursor control keys at the bottom right, one for up and down, the other for left and right. The letter keys carry two graphics characters on their front. The numeric keys situated along the top, carry colours except 9 and 0 which have RVS ON and RVS OFF. The four function keys on the right of the main keyboard are labelled F1 to F4 but also carry a sub-label of F5 to F8. Clearly each key has a number of different functions.

The machine powers up with the keyboard in Upper case/Graphic mode; text is displayed in upper case only, using the SHIFT key gives access to the right hand of the two graphics characters on the letter keys, but the normal shifted characters above the numerals. In this mode CONTROL can be used with numerals 1 to 8 to set the colour of characters displayed to the colour shown on the key; the colours in this main colour set are black, white, red, cyan, purple, green, blue and yellow. CONTROL and 9 will reverse the display, CONTROL AND 0 will restore it to normal.

The mode can be switched to upper/

lower case by pressing the COMMODORE key and the SHIFT key together; in this mode upper and lower case characters are available from the letter keys using the SHIFT key as normal, but using the COMMODORE key instead of the SHIFT key gives access to the graphics character on the left of each letter key. The alternative set of eight colours is now available on the number keys, these being orange, brown, light red, grey 1, grey 2, light green, light blue, and grey 3. The COMMODORE and SHIFT keys will switch back to Upper/Graphic mode.

The COMMODORE key is also used when loading cassettes. The RUN/STOP key can be used to stop a Basic program while running and can be used for a warm restart in conjunction with the RESTORE key. The INST/DEL key acts as a backspace-delete or when shifted it will move text one space to the right inserting a space. The CLR//HOME key takes the cursor to the top left corner of the screen and when shifted it also clears the screen.

Editing

Full screen editing is available as standard. The two cursor keys, in conjunction with the SHIFT key which is conveniently right beside them, can be used to correct or enter text or graphics characters anywhere on the screen. When RETURN is pressed the contents of the line under the cursor are taken as input as though they had just been typed. This works even if the "line" is in fact longer than the 40 characters allowed on the screen.

The only keys which repeat are the cursor keys and SPACE. This confused me for a while, being used to auto-repeat on all keys, but I got used to it very quickly. The only snag I found was after making a change and moving the cursor back down using the RETURN key as is my habit; every line is re-entered as it is passed including READY which is interpreted as READ Y and produces an "Out of Data" error message. The keyboard looks and feels solid and easy to use, though the keys did not "click" positively enough for my taste.

Display

The display was good with edges being quite reasonably sharp and text clear. There are 25 rows of 40 columns, which is about the most that you can get out of a domestic television. The colours are bright and clear though I could discern a rainbow effect looking close – my television is getting a bit old though, and I have found a number of machines that give better displays when put on a more modern set. I tried the display on a black and white monitor and got a crystal sharp effect. I am surprised that there seems to be no immediate provision for an 80 column display which I would have thought at least desirable, if not necessary for serious business use.

Software

The Basic in this new machine will also come as no surprise to VIC or PET users; it is the standard Version 2 Commodore Basic which does look a bit antiquated now. Variable names can be any length, but only the first two characters are significant. Strings can be up to 255 characters. Integer variables are available using the %, but no double precision limiting real values to 9 digits (10 held internally). There are no control structures apart from FOR ... NEXT, GOTO and a simple IF ... THEN..., and no named procedures.

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control of printers, joysticks and other devices. The tape interface is quite standard for Commodore machines, though running at a different speed. It worked perfectly throughout the test. I did not have the opportunity to try the disk unit but it should work here as well as it does on the VIC.

There are two system variables TI and TI$, that give access to a real time clock. TI contains the number of units of 1/60 sec since the machine was switched on. TI$ is a 6 character string containing the time in hours, minutes and seconds. It starts at 0 but can be assigned a value to set the time. A further system variable ST contains information on input/output status which can be used to detect errors, though no details of how to do this are given in the manual.

The Benchmarks show that the 64 is in fact a little slower than the VIC but still quite reasonable compared to its main competitors. The major lack however is the almost complete absence of commands to handle the extensive graphic and sound capabilities of the machine. The only way to achieve effects is extensive use of PEEKS and POKES and although the manual goes into some detail about the various memory locations and registers which can be used for these purposes the method is quite cumbersome.

Compatibility

The advantage of retaining the same basic language as the VIC and the PET is, of course, that the machines then become software compatible. It means that the 64 will be able to use not only the vast range of games and home programs for the VIC but also the large quantities of good business software available for the PET. The software will in general not be immediately transferable, because the PEEKS and POKES will be different, as will any USR functions or SYS calls, but it should be fairly easy for a reasonably competent home-programmer to transfer a VIC program and no doubt software to do it will become available soon. Software to make the 64 emulate a "new ROM" PET has already been announced by Commodore. A warning though that the cassette speeds are different so VIC software must be transferred via a disk.

Future add-ons

The faults with the Commodore 64 Basic will also be cleared up, for disk based systems anyway, by another new item of software called "Simon's Basic" which should be available very soon. This will give structured programming, named procedures and direct commands to handle graphics and sound. I would have preferred to see this as the standard. Other projected software includes a number of games and educational programs, obviously carried over from the VIC. But emphasis is given to a new range of software especially written for the new machine including a word-processor, a spreadsheet, a data-management package and a spelling checker as well as other languages such as UCSD Pascal, Logo, Pilot, Comal and Lisp. Even more important is the projected Z80 add-on card which will provide the 64 with access to CP/M and unlimited software.

Other projected add-ons include RS232 and IEEE interfaces and networking capabilities. Speech synthesis is promised for this September and voice

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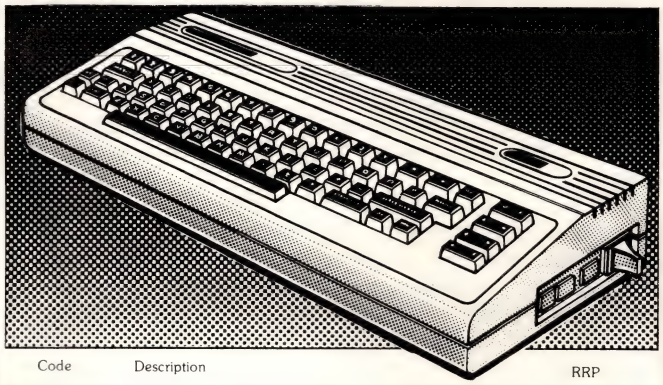

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recognition for the following January. Dates may well be moveable as always in this business, but clearly the 64 will be the centre of a very sophisticated computer system with access to a very large software base.

Inside

Taking the lid off the 64 means undoing three screws at the front. Then the top comes off with the keyboard which is a separate unit. The lead on the keyboard is not quite long enough to be able to lay top and bottom side by side but it disconnects easily, as does the lead to the power LED.

Inside is a single board occupying the whole space. The processor is a 6510A, a development of the 6502 used in other Commodore machines. Memory comes in the now standard form of 8 × 64k dynamic RAM chips. There are the usual cluster of peripheral control devices and a total of 20k of ROM in three chips. The video circuitry is on its own and screened by a metal case from the rest of the machine as are some of the external connectors. The whole is surrounded by what I can only describe as a sheet of conducting cardboard. This is clearly a professional job as you would expect from a company like Commodore and the overall impression is of solid reliability.

The memory map is not given in the manual though addresses are given for the screen and various control registers. Overall there is a total of 54k of RAM which is available to the user though 16k of this is in parallel with the Basic interpreter so from Basic only 38k is left. There is 4k of ROM on top of Basic and 3k of system RAM. Unlike the Z80 and its relatives all input/output ports will appear on the main memory map so a true 64k is difficult to achieve on 6502/6510 machines.

Graphics

The graphics capabilities of the Commodore 64 are quite extensive. They represent a reasonable compromise between the speed and economy of memory of graphics characters against the convenience and quality of true bit-mapped high resolution graphics with its demands on memory.

There are three ways of using the 64's graphics. The first is by the graphics characters available from the keyboard and through the CHR$ function; all graphics characters as well as control characters can be entered between quotes in a Basic string assignment. This makes it quick and easy to program many static pictures, such as Bar charts for example. The second way is to use POKES to play around in the video registers to give a 320 by 200 pixel resolution; this is not very easy or convenient but may be made easier with "Simon's Basic".

The third and most interesting technique is the sprite graphics where high resolution shapes can be plotted on a 24 by 21 grid and can be made to move around the screen, enlarge and diminish through values POKEd into various sprite registers. They can be made to pass behind one another and collisions can be detected. Up to eight sprites can be active at any one time. Once again the process of defining and manipulating sprites is quite complicated from the standard Basic. The sequence that must be followed to define and use a simple sprite is first to plot the required shape on a 24 across by 21 down grid using graph paper. Each row of 24 on/off bits is interpreted as 3 bytes and the resulting 63 8-bit binary numbers converted to decimal. These 63 data values are transferred to a block of 63 bytes somewhere at the beginning of memory – the number of this block (in multiples of 63 from 0) must be POKEd to a particular register so that the sprite knows where to get its data. The starting address of the video registers is at 53248 and the number of the register is added to this base address to get the address of the register into which the appropriate values can be set.

Motion is achieved by updating the X and Y co-ordinates. The user must be able to convert between one or more '1's in an 8-bit binary pattern representing one or more sprites being manipulated into a decimal number. Collisions can be detected by PEEKing at registers and determining whether or not particular bits have been set. Sprites can be any of the 16 colours or a special multi-coloured one. One problem arises with the use of an 8-bit register to hold the X co-ordinate since this gives a maximum value of 255, whereas the screen width is 320. To move past the barrier needs the setting of the Most Significant Bit for the appropriate sprite in register 16, which effectively makes the X co-ordinate into a 9-bit number and hence up to 511. The sprites are not particularly fast when used from interpreted Basic but speed should increase when compiled Basic or Assembly code is used to give some good games effects.

The normal characters can be POKEd into the screen, which occupies 1000 bytes from 1024 in a straightforward row by row one byte per character grid, but the character codes to be POKEd are not ASCII. A parallel 1000 bytes starting at 55296 controls the colour in each character position which can be again be set by POKEing the appropriate colour code into the correct place.

Sound

The sound generation facilities are another strong feature of the Commodore 64. Again the standard Basic leaves you to set all the various features of a sound by POKEing into various registers but the facilities are excellent and the quality good.

The first thing to note is that the sound actually comes from the television set; there is no in-built loudspeaker. An audio output is available from the same connector as the video output and enables the sound to be played through an amplifier or a domestic hi-fi. It has been claimed that the sound produced by this machine is as good as some synthesisers, I think this is overstated but the quality is as good as I have heard and the range of settings available is quite staggering.

There are three voices occupying a range of registers from 54272 to 54292 inclusive. It is possible to control for each of three voices: volume (a range of 0-15), attack/decay and sustain/release, frequency, waveform, and pulse rate. Values are given in the manual to play notes over 9 octaves and in a variety of voices ranging from piano to trumpet as well as suggestions for found effects. A piano keyboard is one of the add-on units that should be available soon and that could be interesting if backed up with suitable software.

Documentation

The Commodore 64 comes with just the one 'User's' manual which purports as usual to be both a manual for the machine and an introduction to Basic (and binary arithmetic in this case). It does not really succeed but it could be worse. On balance it is much better than many Commodore manuals in the past. My main criticism is its small size: the reader is pointed towards the 'Programmer's Reference Manual' for further information but this has to be obtained separately. There are some major omissions from the 'User's Manual', notably the only mention of the function keys is to point out how useful they could be, but nowhere does it mention how to use them! I would think that the 'Programmer's Manual' was necessary enough to warrant inclusion as standard.

To emphasise the dual nature of the Commodore 64 the manual seems to assume that many users will be attaching a disk drive so all instructions for loading and saving programs, and for the use of data files, duplicate for disks and tape.

The manual gives a number of useful examples to illustrate the use of Basic and the various facilities of the machine. Tables are included in the appendices for the video control and sound registers and clear instructions on how to POKE to the screen and the screen colour area.

Although it is quite well written the manual does seem to fall between two stools; the novice may well find some of the tables and the binary arithmetic a bit daunting and require something which

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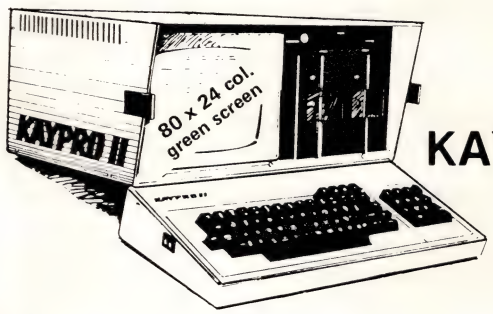

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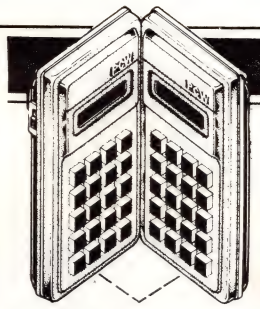
takes a bit more time over their use. On the other hand a more experienced user would feel a bit restricted by the absence of the Programmer's Manual and so would need to buy it straight away.

Conclusions

The Commodore 64 is what you might expect from a major manufacturer like Commodore: a professional high quality machine with a guaranteed large software base. There is nothing startlingly new about this machine, in some ways it is a marketing ploy like the new Apple IIE: upgrading a well-tried and proven architecture with the most modern technology. This allows the manufacturer to launch a product which will compete on equal terms with the new machines while armed with peripheral attachments and software already available. That has to be a recipe for success. The VIC printer, joysticks, disk drives and others will all work on the 64, new sophisticated add-ons designed for this machine will be available shortly.

It is a good machine with all the facilities that a home user would require, although I have my doubts as to its usability as a business system, but this will depend on much on the software. There are machines around now or coming soon which will overtake the Commodore 64 in specification but the 64 will have the same advantage that the VIC enjoys, namely that it along with its peripherals and software will be available in large numbers.

END



SHIRT POCKET CASIO

Dick Pountain takes a close look at the latest pocketable computer — the Casio PB-100

At the top end of the portable computer market all is chaos. Osborne has spawned a host of lookalikes too numerous even to remember their names. In the middle, Epson has opened up the "book sized" market and others like TI and NEC are following. But the bottom end (pricewise) of the market is still dominated by a silent struggle between two companies, Sharp and Casio. I hesitated before saying "bottom" end because in many ways these machines are in the vanguard, attacking problems of miniaturisation which their bigger rivals are for the moment avoiding by using standard micro industry parts. But if the future really does lie in a "pocket mainframe" then the technology which Sharp and Casio are putting into machines like the 1251 and the PB-100 is pioneering stuff; despite which many people will still regard them as glorified calculators.

The latest round in the war involves the almost simultaneous launch of the Sharp PC-1251 (reviewed in February) and Casio's PB-100, the subject of this review. Both machines are basically scaled down versions of previous models which, by using very L:arge Scale Integration, have retained all the functions of their predecessors in a much smaller, more attractive, package and at a reduced price. The PB-100 is a replacement for the fx702p which is currently being sold off at a discount to clear stocks.

Hardware

The PB-100 comes in a slim alloy and plastic case measuring 163×70×10 mm which makes it rather longer than the Sharp but equally "shirt-pocketable". Despite its extra length it has a smaller display, which holds 11 characters on a 7×5 dot matrix. At the top of the display are several small character annunciators for the different operation and angular modes and to display the number of program steps remaining.

The keyboard is completely redesigned in qwerty layout (the 702p was abcd alphabetic) and has nicely spaced keys; like the Sharp however it lacks a proper space bar, space being hidden among the other keys. The idea of single keystroke Basic reserved words is retained from the 702p; each main key has in fact four functions, the second two being obtained by entering EXTension mode. Normally shift will produce a Basic word – eg, shift A gives GOSUB – but in EXT mode one gets lower case letters which shift to special graphics characters including some Greek letters. The equivalent of Enter or carriage return is a large key called EXE which lives in the numberic keypad. This is very convenient as it allows the PB-100 to be used as a calculator with only one hand.

The 702's CONT key is gone; now we have a STOP key which suspends program execution and EXE restarts it. The ANS key is retained which recalls to the display the result of the last calculation performed even if the power has been switched off in the meantime. MODE, shift and cursor left and right are placed in their own small pad above the main keys. Ten modes of operation are provided, namely RUN, WRT, EXT, trace on and off, print on and off, and three angular modes.

A peep inside the case (easy for once as screws are used for fastening) reveals the true achievement in integration as processor, RAM and Basic ROM are all on a single chip about half the size of a postage stamp. In addition an interesting new kind of flexible cable is used for bus connections which appears to have black plastic conductors instead of metal! Two lithium cells provide 360 hours continuous operation which translates into around two years of normal use. Next to the battery holder is space for an extension RAM module which was fitted to the test machine. The standard RAM fitted is 544 steps plus 26 memories (ie, variables), which adds up to 752 bytes since the Basic is fully tokenised. The extra RAM pack adds a further 1k to give 1568 steps and 26 memories. The memory is repartitionable using the DEFM command; one could have 94 memories (222 with RAM pack) and no program space. This is quite substantially less memory than is offered by the Sharp 1251 which comes with 3724 bytes of user memory as standard.

A glance at the Benchmark timings will show that this processor is fast for an ultra-miniature CMOS device; up to 5 times faster than the PC1251 on certain functions.

It goes without saying of course that the PB-100 is all CMOS with permanent memory and auto power off after seven minutes. As is now the fashion, a somewhat redundant contrast control is fitted. There is no real time clock/calendar function.

Benchmark timings

BM1	8
BM2	39
BM3	82
BM4	80
BM5	105
BM6	160
BM7	220
BM8	341

All timings in seconds. For a full explanation of Benchmarks see APC November 1982.

Operation

The PB-100 works very nicely indeed as a calculator due to the thought which has gone into the user interface. Chained calculations are performed exactly as they would appear on paper with the added benefit that the display can be edited using the cursor (pressing ANS once in the middle of a calculation puts the editing cursor on the display; hitting it again recalls the last result calculated). When using functions like SIN and LOG no parentheses are required around the argument which saves a lot of fiddling with shifted characters. Arithmetic is to 12 digits with 10 displayed (8 if an exponent is used); dynamic range is the usual 10^+/−99. Two numeric formats are supported; fixed point scientific (selected by SET E n) or floating point (SET F n) with rounding to n digits on the display only; SET N cancels any format and the full 12 digit numbers are available internally. Scientific format (eg, 1.3456E24) is automatically selected for

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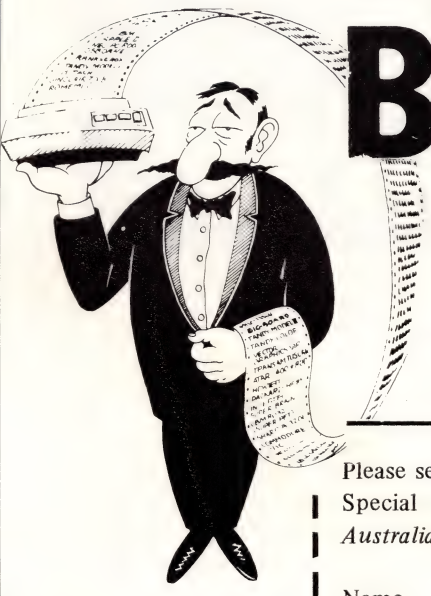

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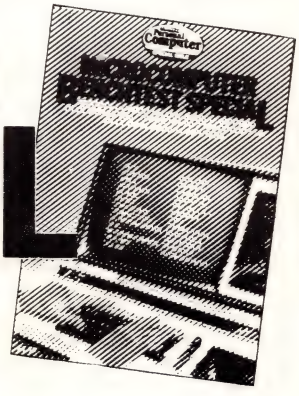

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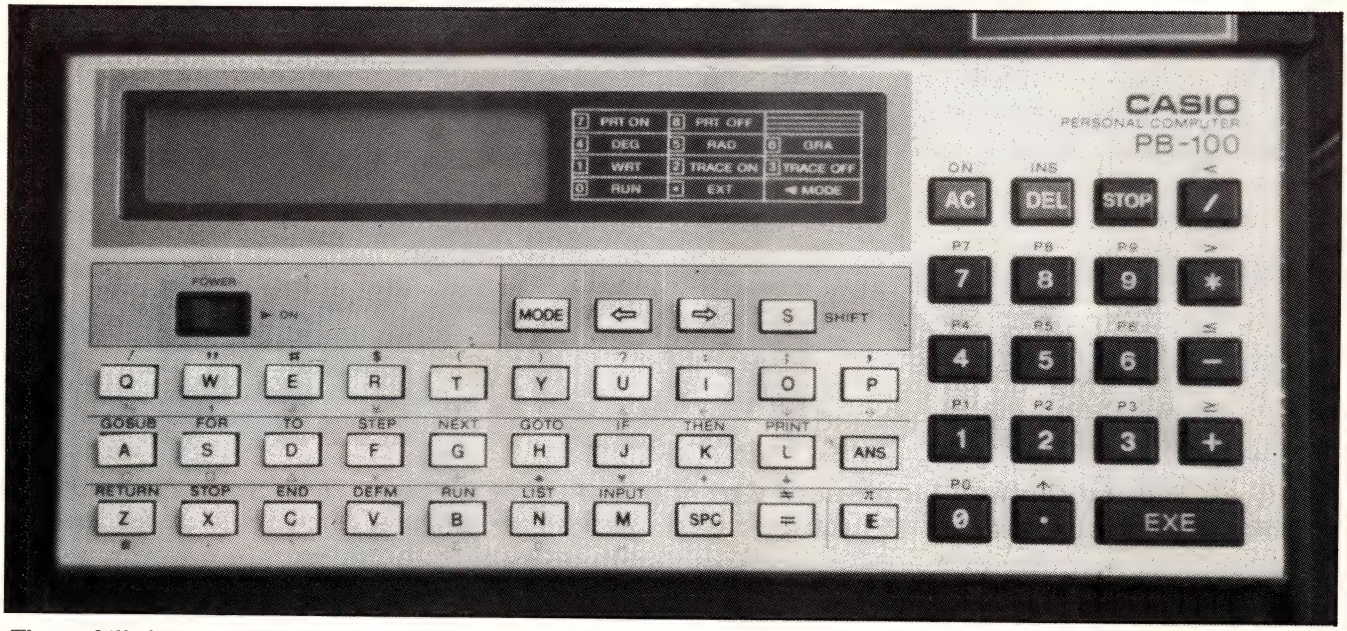

The no-frills basic model.

numbers above 10^10 or below 10^−3. All the transcendental functions normal to Basic are supported but the extra statistical functions of the 702p have regrettably been abandoned; they must be entered as a program if required.

In other respects the Basic and operating system follow closely that of the 702p; 10 program areas called P0-P9 can be selected to hold separate programs and can be saved individually or all together on tape using the optional FA-3 adaptor. The Basic offers fairly spartan but useful facilities; in particular the only string functions are MID (for extracting a substring) and VAL (string to numeric conversion) and the former only works on the special 30 character variable $. All other string variables are limited to seven characters. The variables are allotted as A-Z or A(0) to A(25) etc; B(0) is the same variable as A(1) and so on. When using subscripted variables as arrays (they don't need to be dimensioned) it is possible for them to overlap with disastrous consequences if you don't watch out.

An irritating omission is the absence of any kind of programmable WAIT for the PRINT function; animated displays are difficult to achieve as PRINT will normally stop execution until EXE is pressed. No machine level interface via PEEK and POKE is available either.

On the plus side, the control structures are quite rich with full computed GOTO and GOSUB either to a line number or to a separate program area. Proper data files can be constructed using PUT and GET which write the contents of a single variable or a contiguous block of variables to tape.

A new thermal printer, the FP-12, is designed to go with the PB-100. It is incorporated in a cradle which holds the computer unlike the older FP-10 which hung on via a cable. The cradle is in two pieces which snap together and seems rather overcomplicated for the job it does. The printer uses 20 columns and puts out a line every second; it runs off internal rechargeable batteries but there is still a drain on the PB-100's own batteries which will last for 40 hours of continuous printing. Printing from a Basic program is performed by selecting and deselecting print mode; there is no LPRINT statement so every print will look like:

```
300 MODE 7        (switch on print)
400 PRINT A,B,C
500 MODE 8        (switch off print)
```

though multistatement lines are permitted and will save a few bytes. MODE 7 can be selected manually from the keyboard to give hard copy for calculations.

Documentation

The PB-100 user manual is the normal flimsy affair produced by Casio but is nevertheless quite complete and better translated on average than some previous ones. However the PB comes with a sizeable paperback book as well, called 'Learn as you go' which is a useful step-by-step Basic tutorial and includes a small program library at the end. It is illustrated with cutesy cartoons in the Japanese manner and is quite readable, if slightly stilted in prose style.

Prices

Casio PB-100	$99.95
1k RAM Pack	$40.00
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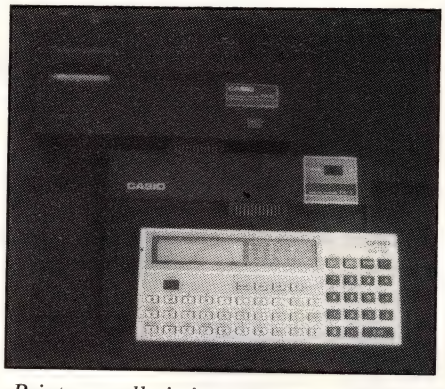

Printer cradle is in two parts and is rather fiddly.

Conclusions

The PB-100 is one more nail in the coffin of the programmable calculator; it provides all the facilities offered by the older calculators in a smart and compact package and is much easier to program. It has a lot less memory and a less powerful Basic than the Sharp PC1251 but then it is cheaper to buy (though the gap narrows once you add in the RAM pack). It is very significantly faster than the 1251 which for applications involving long iterative computations could be crucial.

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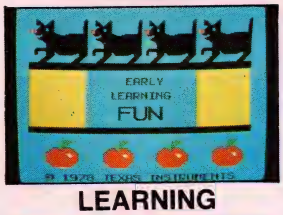

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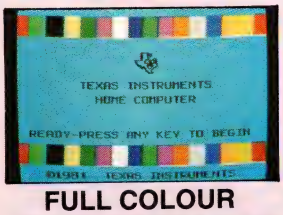

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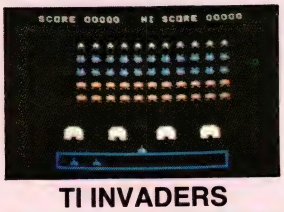

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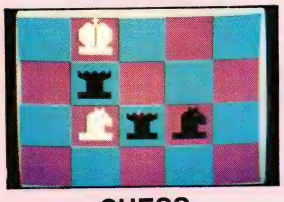
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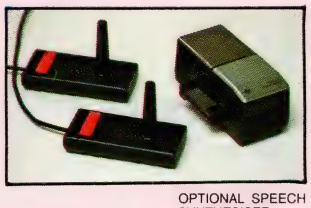

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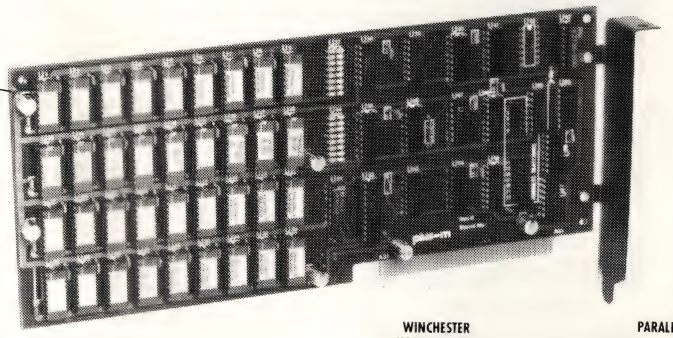

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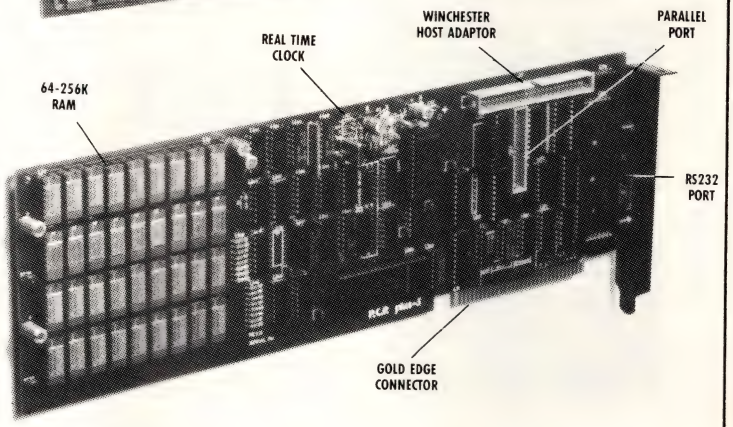

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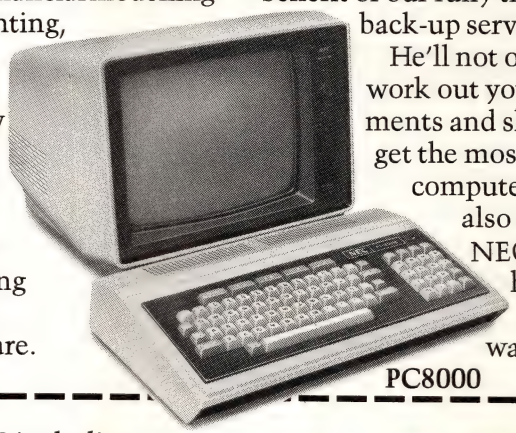
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VIC CHARACTER BUILDER

The availability of user defined graphics on the VIC is quite well documented (TJ's Workshop January 1983 and July 1982). Basically the VIC normally looks in ROM (a 4k block from 32768 (hex 8000) to 35225 (hex 8999) for the picture of the character). By changing the value held in location 36869 (hex 9005), one of the VIC chip's control registers, it is possible to make the VIC look in another part of memory (either RAM or ROM) for this information (Table 1).

Normally each character is made up of an 8 x 8 dot matrix, but by having a 1 in bit 0 of location 36867 (hex 9003) each character is double height, being made up of an 8 x 16 matrix. In this mode each screen location is twice as big and all characters appear twice as tall (including listings, etc). The number of rows on the screen must also be changed as 23 double height characters will not fit on the screen.

The number of rows is also kept in location 36867 so to give a screen with 15 rows of double height characters POKE 36867,31 (31 is twice the number of rows plus one). To have this number of rows the vertical centering of the screen must also be changed; this can be done with a POKE 36865,26. There is still a problem, as ecah character now requires twice the amount of information as for two normal characters — for example, pressing the '@' would result in a '@' being printed above an 'A'.

The way to get around this is to program the letters in the same way as user defined graphics. With normal characters this is done by defining each character with eight 8-digit binary numbers, or denary (base 10) numbers in the range 0 to 255. To get double height characters 16 numbers are needed. This could be done by typing them in DATA statements, but this would take up too much memory as 16 bytes have to be reserved for every character anyway. The other way is to use the characters stored in ROM but instead of using each value once to use it twice.

This short program

Value in 36869	Characters start	Contents of location
240	32768	Character ROM — upper case & full graphics
241	33792	Character ROM — upper case & graphics reversed
242	34816	Character ROM — upper & lower case with some graphics
243	35840	Character ROM — upper & lower case with graphics reversed
252	4096	Start of Basic RAM (unexpanded VIC)
253	5120	Basic RAM
254	6144	Basic RAM
255	7168	Basic RAM

(The above is an expansion of a Table in the Programmer's Reference Guide.)

Table 1

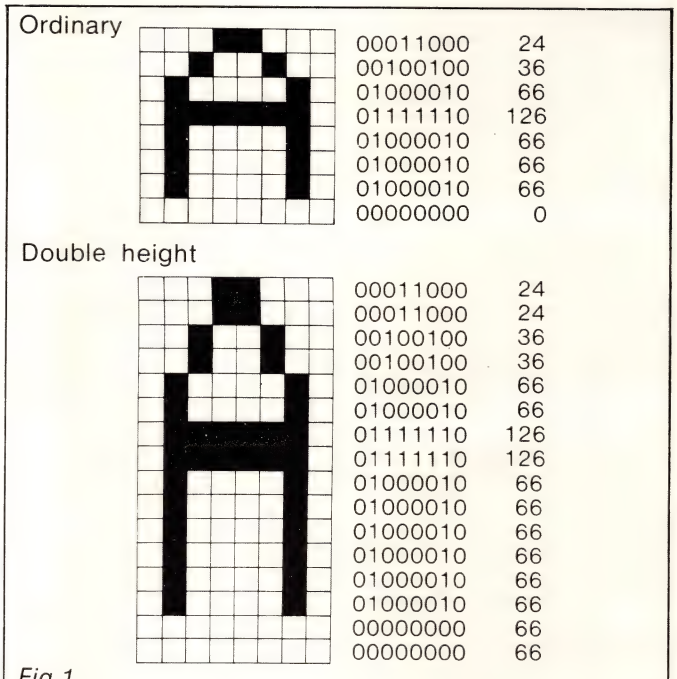

Fig 1

Value A	*Value B*	*Value C*	*No Chars*	*Amount memory used*
7168	*255*	*28*	*32*	*512*
6144	*254*	*24*	*96*	*1536*
5120	*253*	*20*	*160*	*2560*
4096	*252*	*16*	*224*	*3584*

Table 2

creates double height characters, reserving enough memory, and can be adapted to define different numbers of characters, depending on how many are needed and how much memory is available (Table 2). It will work on the unexpanded VIC, on the VIC with 3k RAM expansion or with the super expanded cartridge (in GRAPHICS 0). The screen will work normally after running the program except the computer thinks there are 23 rows although there are only 15, and you can therefore move the cursor off the bottom of the screen.

Andrew McSean

OBSCURE 1500 CODE

The long and laborious task of learning about machine code on the Sharp PC-1500 in the absence of a manual on the subject is, perhaps, more interesting than useful, but I have turned up a few things which could be of use. Here are three of them:

ON ERROR GOTO provides a handy means of trapping and dealing with errors, but PC-1500 Basic provides no way of finding what error occurred, or where. This information is obviously vital for programs in which more than one error can occur. After some searching I have found the three relevant locations. PEEK(&789B) gives the error number, while PEEK(&78B4) * 256 + PEEK(&78B5) returns the line number where it happened.

CALL &CD71 turns the computer off. I'm sure there must be a use for this, but I can't think of one at the moment!

When the novelty of BEEPing wears off, try this program. It provides a sound rather reminiscent of a death-ray (no relation) or a siren.

```
1 REM ABCDEFGHIJ
  KLMNOPQR
3 DATA &5A, &10, &6A,
  &10, &48, &01, &4A,
  &10, &BE, &E6, &6F,
  &62, &99, &06, &52,
  &99, &0F, &9A
5 FOR I = 1 TO 18 :
  READ A : POKE &40C9
  + I, A : NEXT I
7 END
```

Line 5 POKEs the machine code routine in line 3 into the REM in line 1. Once this has been done lines 3 - 7 are no longer needed, and CALL &40CA will produce the sound. Note that the REM must be the first line in the program for this address to be correct.

For those interested, see the assembly code.

Anyone with machine code experience should have little difficulty in understanding this.

&40CB holds the number of repetitions of the basic sound effect, and PITCH and LENGTHLO

```
40CA 5A 10          LSSI CYLCES
40CC 6A 10    L1:   LDBI PITCH
40CE 48 01          LDGI LENGTHHI
40D0 4A 10          LDFI LENGTHLO
40D2 BE E6 6F L2:   JSR BEEP
40D5 62             DECB
40D6 99 06          BRNZB L2
40D8 52             DECD
40D9 99 0F          BRNZB L1
40DB 9A             RTS
```

TJ's WORKSHOP

both affect its character — experiment with these.

If anyone else is experimenting with machine code on this machine I would be interested to hear from them.

Malcolm Ray

CBM CRT CONTROL

The later versions of CBM computers, which have 12in screens differ from their predecessors by having CRT control chips which manage the operation of their VDU screens. The chip fitted is an HD46505 — in some machines, at least. This behaves as if it is equivalent to the 6845, which is often said to be the one used. The workings of the chip are controlled by 19 registers. The first, the address register, may be written to, using the instruction POKE59520,X. A value for X of zero to 17 directs attention at address 59521 to register X. Hence the following instruction POKE59521,Y will set register X to a new value Y.

Most of the registers are best left alone, as they determine matters such as the scanning frequency and

screen geometry. Flexibility of these is of benefit when designing hardware, but it is hard to imagine any useful purpose in changing them during normal operation. At switch-on the chip registers are initialised from a table. In the 4000 series the values for registers 17 to 0 are held in addresses 59348 to 59331 and entered by a subroutine starting at 58903. If, by accident or design, the critical registers become deranged the display breaks up or disappears completely. The CRT heater may even be turned off! Such disasters can quickly be averted by a call to SYS58903.

Some of the registers, however, can give useful variations. Register 6 sets the number of text lines which are displayed. This is normally 25, but any lower number has the effect of concealing later lines of text, even though they remain in the screen memory. Thus,

```
POKE59520,6:
POKE59521,0
```

will extinguish the display. Poking increasing numbers to 59521 will then reveal the screen again line by line.A variety of tricks can be played with register 6.

Register 1 has a similar effect in the horizontal direction. POKE59520,1: POKE59521,22 rearranges the format to give only 22 characters per line, giving a simulation of a VIC display. However, the characters are still their usual size and so the picture width is nearly halved.

Registers 12 and 13 control the address of the first character to be displayed (high byte, low byte). The 6845 has 14 address lines for controlling this, but only ten of them (A0 to A9) are used for this purpose. Their relationship to the normal display RAM is logical: zero on the lines A0 to A9 causes the display to start at the usual point, 32768. Entering 1 means that the first character in the display RAM is missed and the display starts with the second character from this area. The address lines A10 and A11 are not used. The line A12 is connected to an exclusive OR gate in the path of the video signal which enables the video to be inverted or not at will, by poking 0 to 16 into register 12.

For normal display A12 is required to be high. The ability to invert the video signal is much less useful than one would have hoped: the problem is that, when inverted, all the normally blanked parts of the display become visible. These include extraneous raster area and the frame flyback path. The highest address line, A13, is connected to pin 18 of the character generating ROM. The ROM normally fitted is a 2048 by 8 bit device, which gives the normal two CBM character sets. Space is available for two extra character sets by fitting a 4096 by 8 bit device. The 2532 PROM has the correct connections and selection between two pairs of character sets would be available under the control of A13.

Registers 10, 11, 14 and 15 are intended for the management of a cursor. As no connection is made to the cursor output signal, no use can be made of these. Registers 16 and 17 are for use with a light pen. They capture the value held on the address lines at the instant that the strobe input receives a positive-going edge. Pin 21 of the memory expansion connector J4 drives this input, via an inverter. However, pin 21 is also connected to the highest

TJ's WORKSHOP

address line of the character ROM, on pin 19. This controls which of the two character sets is in use, giving the odd result that a number is latched into the light pen registers each time that the character set is shifted from upper/lower case to graphics.

Registers 0 to 11 are write-only. Registers 12 to 15 are read/write and the light pen registers, 16 and 17, are read-only. Read/write registers 14 and 15 can be used for storage, but note that registers 14, in common with registers 12 and 16, has only six working bits.

R B D Knight

BINARY CHOP

Searching string arrays for a particular value can be a very time-consuming business. This subroutine (lines 500 to 630) cuts down the search time considerably by using a technique which is sometimes called the 'binary chop'. In this method, which can only be used on arrays already sorted into ascending or descending order, we first look at the string in the middle of the array. This locates the target string in one half of the other and this half is again divided into two and the process repeated until the required string is located or we can decide it is not present. This is a straightforward sequential search.

The program was written to suit most varieties of Basic. Lines 30-150 are a short program to test the subroutine, array A$ is filled with 676 strings of two characters each in order AA,AB. . .ZZ, at line 120 the user inputs a two character string and the program prints its position in the array (J%) together with the contents of this position.

The subroutine needs

```
  10 REM SEARCH PROGRAM TO LOCATE A GIVEN
 STRING IN A STRING ARRAY. THE ARRAY MUST
BE IN ASCENDING SEQUENCE.
  20 :
  30 DIM A$(675)
  40 FOR I%=1 TO 26
  50   K%=(I%-1)*26
  60   FOR J%=1 TO 26
  70     A$(K%)=CHR$(I%+64)+CHR$(J%+64)
  80     K%=K%+1
  90     NEXT
 100   NEXT
 110 S%=0:E%=675
 120 INPUTITEM$
 130 GOSUB500
 140 PRINTJ%"  "A$(J%)
 150 GOTO110
 160 :
 500 F=0
 510 TD%=S%+(E%-S%) DIV 2
 520 IF (E%-S%)>4 GOTO590
 530 I%=S%-1
 540 REPEAT
 550   I%=I%+1
 560   IF ITEM$=A$(I%) THEN F=-1:J%=I%
 570   UNTIL I%=E%
 580 GOTO630
 590 IF ITEM$<A$(TD%) THEN E%=TD%:GOTO510
 600 IF ITEM$>A$(TD%) THEN S%=TD%:GOTO510
 610 J%=TD%
 620 F=-1
 630 RETURN
```

TJ's WORKSHOP

three parameters to be filled: ITEM$ must hold the string for which you are searching, S% = start-search and E% = end subscript for search. After calling the routine F=-1 if the ITEM$ was located else F=0, and J% gives the array subscript if the search was successful.

Richard Grubb

SHARP HINTS

The Sharp PC-1500 pocket computer has no instructions to position the display cursor *relative* to its current position, but location 30837 holds the cursor value. So

GCURSOR PEEK 30837 + n

has the effect of an 'RGCURSOR n' instruction — moving the cursor n columns to the right of its current position. If n is negative, the movement is to the left. This is handy when the 'display length' of an item of output is not known in advance.

Note that if the most recent PRINT, PAUSE or GPRINT statement was not terminated by a semicolon or comma, the current cursor position will be zero.

Now here's how to recover a program which you've just deleted accidentally, using 'NEW' or 'NEW 0'. The first thing to do is

POKE 16581,0

(assuming your first line number was less than 256). At this point, the DEF key can be used to run any suitably labelled part of the old program, but no other method of initiation will work, and the program cannot be LISTed.

In order to fully restore the program, you need to know what its length (STATUS 1) was. Add this to 16580 (40C4 hex) and convert the result to hex — say you get XXYY.

Now,
POKE 30823,&XX
POKE 30824,&YY

and the program is back.

If you don't know the length, count four for each line (this takes account of the 2-byte line number, pointer byte and carriage return), two for each reserved word, and one for every other ASCII symbol in the program; finally add one to get the value of STATUS one. Or if you don't have a listing, make a guess at the program length (try to underestimate), add 16580 and PEEK around locations in this vicinity until you find the byte value 255; its address is the XXYY needed above. Although this search cannot be programmed, as that would corrupt the program you're trying to retrieve, it can be speeded up considerably by the judicious use of a couple of reserve keys.

On the other hand, a suitable machine code program could be stored in the reserve of RAM, as has been done on many other machines. Does anyone out there know when Sharp plans to release the processor instruction set and monitor listing?

K Kerr

64 KEY-BOARD MATRIX

When I came to convert a PET program that PEEKed to location 151 for a keyboard matrix number to control its logic I found that the description of the 64's keyboard matrix given in pages 93-94 of the Commodore 64 Programmer's Reference Guide appears not to be completely correct. If no key is depressed then a value of 64 is returned in

location 197 as the Guide says.

However Appendix C gave me no help in determining the numeric values for the other detectable keys. There is an example in Basic at the bottom of page 93:

```
10 AA=PEEK(197):
   IFAA=64THEN10
20 BB$=CHR$(AA)
```

to which I added:

```
30 PRINTCHR$(AA)
```

I then said RUN and depressed various keys and got some unexpected results. I thought from the manual I would get the same character printed as the key I depressed, but in fact got a completely different one.

So I systematically went through the keyboard and noted the 64's actual keyboard matrix which I have listed. It is not the same as that for any PET/CBM that I have any information about. Nor is it the same as the VIC's which is explicitly listed in the Commodore VIC Programmer's Reference Guide. I did think it might be the same as the VIC's as the keyboard looks externally identical to the VIC's. The only functional difference that I know about is the use of the Commodore logo key in conjunction with the numeric keys to give the extra colours. I thought this should not change the basic keyboard matrix that ignores the shift et al. keys. It was a surprise to me as a VIC user to notice from the PET information that PET/CBMs have the left and right shift keys *included* in their keyboard matrices.

I could not detect any number value for the CTRL, Restore, Shift/Lock, Commodore logo, or either of the Shift keys.

Ron Hewett

Number	Key	Number	Key	Number	Key	Number	Key
0	DEL	16	5	32	9	48	£
1	RETURN	17	R	33	I	49	*
2	CRSR ⇔	18	D	34	J	50	;
3	F7	19	6	35	0	51	HOME
4	F1	20	C	36	M	52	(None)
5	F3	21	F	37	N	53	=
6	F5	22	T	38	O	54	↑
7	CRSR ⇕	23	X	39	N	55	/
8	3	24	7	40	+	56	1
9	W	25	Y	41	P	57	←
10	A	26	G	42	L	58	(None)
11	4	27	8	43	-	59	2
12	Z	28	B	44	.	60	SPACE
13	S	29	H	45	:	61	(None)
14	E	30	U	46	@	62	Q
15	(None)	31	V	47	,	63	RUN/STOP

PRINTER FIX

Having recently bought an Epson MX-80, I quickly realised how out-dated Level II Basic really is. It appears that the person who wrote the current printer driver assumed:

1. Anyone sending a 0 to the printer must have made a mistake, so ignore all 0s.
2. LINE FEED (10D or 0AH) does the same thing as CARRIAGE RETURN (13D or 0DH), thus change all the 10s to 13s.
3. A form of paper is usually 66 lines long. When someone issues a FORM FEED (11D or 0BH), send sixty six 10s instead.

Anyone with a modern printer will know how useful 0s are (e.g. turning off the underline mode on the Epson range). So I sent all of my 0s straight through the printer port (FDH for System 80s or 37EBH for TRS-80s).

Finally, I could use bit image graphics on my Epson. This assumption was fatal. All my 10s were printed as 13s. In frustration I changed all 10s to 11s, which should look better than a 13, but, for each 11 I got sixty six 10s!

So now all of my data has to be sent through the printer port checking each time that the printer is ready to receive each byte. Result: extremely long printout times.

Also, if I accidentally sent a large load of data to the printer while it was turned off or disconnected, my System 80 responded only to the reset button.

Two days of wading through various reference books, hours at the computer with DBUG and Z-BUG, produced Printer Driver Plus Version 1.0. It allows the sending of 0s, 10s, 11s and 12s to the printer correctly, as well as allowing the use of the BREAK key to halt printing. The listing shows it assembled for 16k. The line with the two #s in its comment column shows the memory size that you

```
                00010 ;*****************************
                00020 ;*** PRINTER DRIVER PLUS ***
                00030 ;*** VER 1.0    3/4/1983 ***
                00040 ;*** WRITTEN BY          ***
                00050 ;*** SIMON SAUBERN       ***
                00060 ;*** 2/227 DANDENONG RD. ***
                00070 ;*** WINDSOR, 3181.      ***
                00080 ;*****************************
4026            00090        ORG    4026H          ;PRINTER DRIVER POINTER
4026 E87F       00100        DEFW   PRINT          ;NEW PRINTER DRIVER ADDR.
7FE8            00110        ORG    32744          ;## MEM SIZE FOR 16K
7FE8 3A4038     00120 PRINT  LD     A,(3840H)      ;ADDRESS OF BREAK KEY
7FEB E604       00130        AND    4              ;VALUE OF BREAK KEY
7FED C2191A     00140        JP     NZ,1A19H       ;IF DOWN RETURN TO BASIC
7FF0 21E837     00150        LD     HL,37E8H       ;PRINTER PORT
7FF3 CB7E       00160        BIT    7,(HL)         ;CHECK IF BUSY
7FF5 20F1       00170        JR     NZ,PRINT       ;YES. GO CHECK BREAK KEY
7FF7 211100     00180        LD     HL,17          ;NO. FIND NEXT CHARACTER
7FFA 39         00190        ADD    HL,SP          ;TO BE PRINTED
7FFB 7E         00200        LD     A,(HL)         ;PUT IT IN 'A'
7FFC 32E837     00210        LD     (37E8H),A      ;SEND IT TO PRINTER
7FFF C9         00220        RET                   ;RETURN TO CALLER
06CC            00230        END    06CCH
```

TJ's WORKSHOP

must give to the computer upon powering up.

Printer Driver Plus Version 1.1 formats each line to 64 characters in length, as well as doing the above. Hopefully, all System 80/TRS-80 listings submitted to *APC* will use this routine as it provides a simple way of checking for errors when entering long lines. Each line in the listing will correspond exactly with what you see on your screen.

BEWARE: Both routines will NOT work with EDTASM+ and don't forget that some programs (such as spread sheets) need 80 columns in their printouts, so use Version 1.0 for these.

(NB: The only differences between the two versions have been marked with ## in the comment column of the Version 1.1 listing.)

The printer drivers can only be used from Basic as the normal ROM calls from machine language routines (such as 3BH) alter the stack pointer.

Simon Saubern

```
                00010 ;*****************************
                00020 ;*** PRINTER DRIVER PLUS ***
                00030 ;*** VER 1.1    3/4/1983 ***
                00040 ;*** WRITTEN BY          ***
                00050 ;*** SIMON SAUBERN       ***
                00060 ;*** 2/227 DANDENONG RD. ***
                00070 ;*** WINDSOR, 3181.      ***
                00080 ;*****************************

4026            00090          ORG    4026H          ;PRINTER DRIVER POINTER
4026 D27F       00100          DEFW   PRINT          ;NEW PRINTER DRIVER ADDR.
4041            00110          ORG    4041H          ;## STORAGE BYTE
4041 00         00120          DEFB   0              ;## ZERO IT
7FD2            00130          ORG    32722          ;## MEM SIZE FOR 16K
7FD2 3A4038     00140 PRINT    LD     A,(3840H)      ;ADDRESS OF BREAK KEY
7FD5 E604       00150          AND    4              ;VALUE OF BREAK KEY
7FD7 C2191A     00160          JP     NZ,1A19H       ;IF DOWN RETURN TO BASIC
7FDA 21E837     00170          LD     HL,37E8H       ;PRINTER PORT
7FDD CB7E       00180          BIT    7,(HL)         ;CHECK IF BUSY
7FDF 20F1       00190          JR     NZ,PRINT       ;YES. GO CHECK BREAK KEY
7FE1 211100     00200          LD     HL,17          ;NO. FIND NEXT CHARACTER
7FE4 39         00210          ADD    HL,SP          ;TO BE PRINTED
7FE5 7E         00220          LD     A,(HL)         ;PUT IT IN 'A'
7FE6 32E837     00230          LD     (37E8H),A      ;SEND IT TO PRINTER
7FE9 FE0D       00240          CP     0DH            ;## END OF STATEMENT?
7FEB 280E       00250          JR     Z,ZERO         ;## YES. RESET COUNTER
7FED 3A4140     00260          LD     A,(4041H)      ;## GET NUMBER PRINTED
7FF0 C601       00270          ADD    A,1            ;## UP DATE IT
7FF2 FE40       00280          CP     40H            ;## END OF LINE?
7FF4 2006       00290          JR     NZ,SKIP        ;## NO. JUMP TO SKIP
7FF6 3E0D       00300          LD     A,0DH          ;## YES. A=CR
7FF8 32E837     00310          LD     (37E8H),A      ;## SEND IT TO PRINTER
7FFB AF         00320 ZERO     XOR    A              ;## ZERO 'A'
7FFC 324140     00330 SKIP     LD     (4041H),A      ;## STORE NUMBER PRINTED
7FFF C9         00340          RET                   ;RETURN TO CALLER
06CC            00350          END    06CCH
00000 TOTAL ERRORS


PRINT   7FD2
SKIP    7FFC
ZERO    7FFB
```

END

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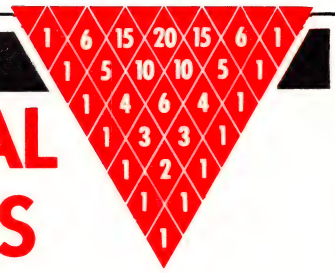
TRIANGULAR, TETRAHEDRAL AND FIBONACCI NUMBERS



Mike Mudge continues his series of puzzles for the maths freaks among us.

The positive integers consist of 1, 2, 3, 4, 5...; a general number in this sequence will be noted by l, m or n.

The Triangular Numbers, denoted by T_l, represent the number of identical spheres that can be packed into a complete triangular array having l rows. Thus $T_1 = 1$, $T_2 = 1 + 2 = 3$, $T_3 = 1 + 2 + 3 = 6$, and in general $T_l = 1/2\,l(l + 1)$.

The Tetrahedral Numbers, denoted by t_m, represent the number of identical spheres that can be stacked in a complete triangular pyramid, or tetrahedron, having m layers – each a complete triangle. Thus $t_1 = T_1 = 1$, $t_2 = T_1 + T_2 = 1 + 3 = 4$, $t_3 = T_1 + T_2 + T_3 = 1 + 3 + 6 = 10$, and in general $t_m = 1/6m(m + 1)(m + 2)$.

In contrast to the above numbers, which are essentially geometrical in origin, the Fibonacci Numbers, denoted by F_n, are here defined algebraically using a recurrence relation $F_{n+1} = F_n + F_{n-1}$ where $F_1 = F_2 = 1$. That is, any term in the Fibonacci sequence is obtained as the sum of the two previous terms. Thus $\{F_n\} = \{1, 1, 2, 3, 5, 8, 13, 21, \ldots\}$; this sequence has so many interesting properties that it has its own publication, *The Fibonacci Quarterly*.

PROBLEM

This month's problem is in three distinct parts, which are seen to have a common logical thread.

a) Which tetrahedral numbers are also triangular numbers (eg, $T_1 = t_1 = 1$, $T_4 = t_3 = 10$)? This problem has been attributed to W Sierpinski, 1970, and others.

b) Which Fibonacci numbers are also triangular numbers (eg, $T_1 = F_1 = 1 = F_2$, $T_2 = F_4 = 3$, $T_6 = F_8 = 21$)? This problem is due to Vern Hoggatt.

c) Which Fibonacci numbers are half the sum or difference of the cubes of two integers – eg, $1 = 1/2(1^3 + 1^3)$, $8 = 1/2(2^3 + 2^3)$, $13 = 1/2(3^3 - 1^3)$? This is closely related to the abstract problem in number theory of finding all quadratic fields of class-number 2.

Submit a program, or suite of programs, which generates answers to the above questions up to some maximum positive integer, N, whose value may be input data. All submissions should include program listings, hardware descriptions, run times and output; they will be judged for accuracy, originality and efficiency (not necessarily in that order). A prize of $25 will be awarded to the 'best' entry received within two months of the appearance of this article.

Submissions to: Mr M R Mudge, C/- *Australian Personal Computer* P.O. Box 298, Clayton 3168.

Note: Submissions will be returned only if suitable stamped addressed envelopes are included.

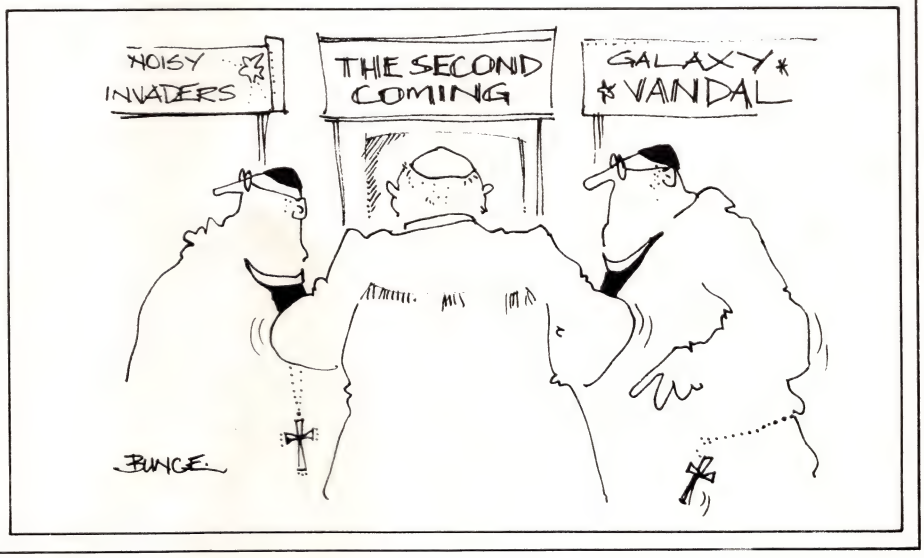
Response to the first article in this series was predictably sparse; however, the 'best' entry has been chosen as that of Robert Merson, who combined some subtle algebraic transformations with a factoring technique to reveal:

$428 = (-117091)^3 + (-111433)^3 + 2(114332)^3$

$491 = (13584908)^3 + (13476659)^3 + 2(-13531000)^3$

$580 = (89845)^3 + (85111)^3 + 2(-87542)^3$

END



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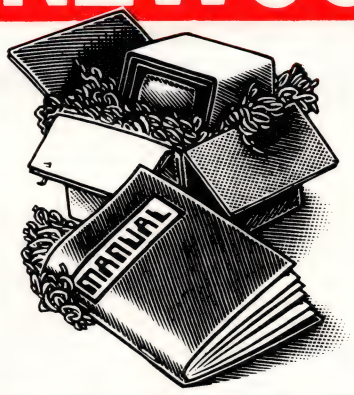


This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in APC. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, *APC* will be publishing this guide — every month.

We'll start by considering the microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them elsewhere. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary.** Binary is a system of numbering which uses base 2 instead of the more familiar decimal — or, to be more accurate, denary-system of base 10. In binary notation there are only two digits — 0 and 1 — which the computer recognises as the absence or presence of an electric current. The easiest way to visualise this is to think of each binary digit **(bit)** as being a switch which can be either off or on. Each binary digit stands for a power of 2. The right-most digit, the least significant, is $2^0=1$, the next $2^1=2$, then $2^2=4$, $2^3=8$, $2^4=16$, $2^5=32$, $2^6=64$, $2^7=128$, $2^8=256$. So decimal 24, for example, is represented in binary as 00011000. A set of eight bits is known as a **byte** and, to make things easier for humans, a third system of numbering, **hexadecimal** or **hex** for short, is used as a sort of 'halfway house' between binary and denary. Hex uses numbers to base 16, with denary numbers between 9 and 16 represented by the letters A-F. The hex equivalent of a byte is obtained by giving each half a single character code: 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101 ... E=1110 and F=111. Our example of 24 is therefore 18 in hex.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). This allocates a numerical code to each digit and letter. For example, the number 5 is given the ASCII code 35 hex, 53 decimal, whereas a capital A is represented by ASCII 41 hex, 65 decimal.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex **(machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the **programming language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic.** Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To **run** such a program the computer uses an **interpreter,** which is usually built into the machine's ROM (see later paragraph on this page). The interpreter picks up each Basic instruction, translates it into machine code and then feeds it to the **processor** for execution. It has to do this each time the same instruction has to be executed. A much faster method is to use a **compiler,** which accepts each instruction in turn, waits until the program has been entered, then turns each instruction into machine code before running the program. This means that each instruction has to be translated once only — consequently the speed of execution is considerably improved.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE.** They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware,** this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU),** a single microprocessor chip with supporting devices such as **buffers,** which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100.**

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic;** all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Erasable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks,** each of which is in turn subdivided into **sectors.** Using a program called a **disk operating system,** the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface, and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for microcomputers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

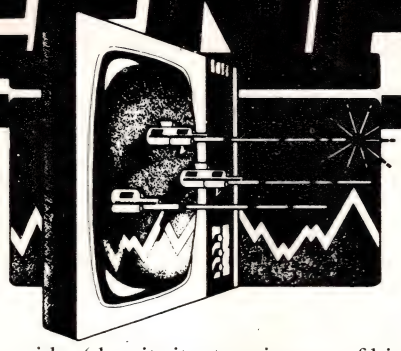
You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU),** which looks like a TV screen with a typewriter-style **keyboard;** sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer.**

The computer can send out and receive information in two forms — **parallel** and **serial.** Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

The ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24)** while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone system, allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need Telecom's permission; instead you could use an **acoustic coupler,** which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — Telecom isn't so uppity about the use of these.

SCREENPLAY



This month Tim Hartnell review games for the VIC-20.

After a couple of days spent happily playing (sorry,hard at work reviewing) cartridge games on the VIC 20, I can see one of the reasons why this computer has proved such a success. With good colour, clear sound, and a highly responsive keyboard, some extremely worthwhile effects can be generated.

The six programs I reviewed are all marketed by Commodore, and will therefore be available through most if not all VIC dealers. I selected cartridges which have proved steady sellers from most VIC dealers, avoiding only the 'Fruit Machine' program which I consider (despite its stunning use of high resolution graphics) to be one of the wettest games ever marketed for the machine. The player input consists of entering a bet and then hitting RETURN. Interactions beyond that is zero, and interest after 10 seconds would be, I predict, zero.

Player interaction is a feature I've looked for in these programs. They are not particularly cheap (not that cartridge software for any computer is cheap) and I think games that provide a feeling pf real control over the outcome, the ability to learn the game to get higher scores as you go on, and enough different possibilities to maintain interest over a long period of time represent a real return on investment. I have looked for these features in the games I reviewed, and have assessed them in light of my findings.

Special thanks to the Computer Factory, 136 Richmond Road, (03) 428 5714, for supplying the review cartridges and the machine to play them on.

GAME: Road Race
PRICE: $37.95

This game is a familiar one. You are "the driver of a car in a road race. You have 99 time units in which to cover as many kilometres as possible". And that's about it.

You see your car, a peculiar squashed yellow shape at the bottom centre of the screen. Below this in the left hand corner is your speedometer (which, like the other gauges is very well represented in high resolution graphics), a rev counter, your gear indicator and a 'gauge indicating engine temperature'. You start the race by pressing the 'I' key (for ignition) then use the RETURN key as an accelerator, and the function keys for the gears. The 'A' and 'D' keys move you left and right respectively.

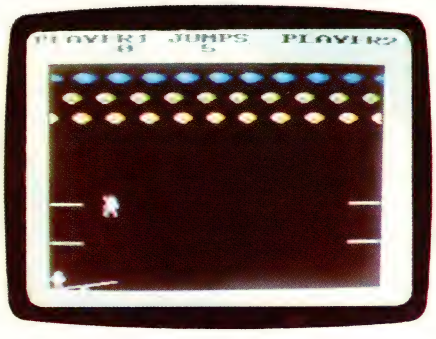
The game, such as it is, consists of keeping your yellow shape between the oncoming white posts, which twist and turn alarmingly. This is not at all easy to do.

I found the sound very convincing, and the response of the 'car' to the accelerator and gear change quite realistic. I wasted at least half of my 99 units stalling, as I got so involved in trying to avoid the onrushing white posts that I forgot to accelerate, or if I remembered to do so, forgot to change gears.

Although the driving effect is quite convincing, and the high score feature gives you something to try and beat, it does not seem to me that the program offers particular value for money. There are no random elements in the game (like cows wandering onto the road, or other cars) apart from the twisting line of posts. Once you have mastered the gear-changing, which would take probably three complete runs, the only fun would be to see how fast you could get the car and maintain control.

I suggest the game might be disappointing after arcade car-driving games, and because of the lack of 'events' while it is running, it seem unlikely to maintain interest for very long.

USE OF GRAPHICS: **
ADDICTIVE QUALITY: **
VALUE FOR MONEY: **



GAME: Clowns
PRICE: $37.95

In this game, you control the sideways movement of a seesaw. The objective of the game (which can be a one or two-player game as you choose) is to keep a pair of clowns bouncing up and down on the ends of the seesaw, so that they burst the maximum number of balloons which are moving back and forth at the top of the screen.

This is a great game to play. The clowns are cute, and collapse in a most alarming way (complete with a high-spirited rendition of a few bars of the 'Death March') when they miss the seesaw and hit the ground. The pace can get quite furious, as is indicated by the demonstration game which fills in between each round while waiting for you to press function key one to start the next game.

To get the greatest amount of propulsion into the upward flight of each clown, you position the seesaw so the clowns land at the very end. Points are scored (naturally enough) for hitting the balloons, with the higher balloons being worth more than those on the longer rows.

The game needs paddles. It will work with the keyboard, or the joystick. You

are not told this on the outside of the pack in any way, so you might get it home and unpack it before discovering you could not play it. I see no reason why the program could not have been written to allow use of alternative inputs, unless Commodore hope that the existence of the pack, and presumably others like it, will stimulate sales of paddles.

Anyway, this quibble aside, the game is good fun. It is far more interesting as a two-person game than when played as a solo affair. I suggest the solo mode would be of most use for practice before setting out to demolish your friends.

This program is dated 1982 (whereas the Road Race is 1981) and its greater sophistication reflects the growing demands of the game market.

USE OF GRAPHICS: ******
ADDICTIVE QUALITY: *****
VALUE FOR MONEY: *****

GAME: Mole Attack
PRICE: $37.95

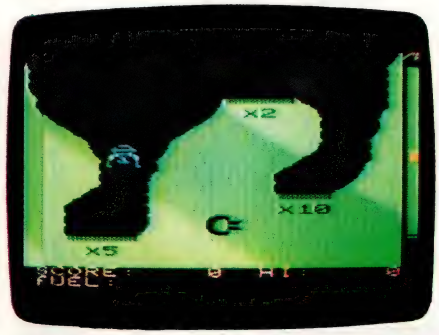
Here's a game to appeal to the anti-ecologist in all of us. Nine innocent, brightly coloured moles (with curiously Asian features) pop up at random on a three by three grid. Using the keyboard, you have to bop the moles on the head as they appear. The further out of the hole the mole is when you bash it with a mallet, the higher the score you'll get. If the mole pops up looking the other way (so you only see the back of its head) and you hit it, you lose points. The further out of the ground it is when you hit it, the more points you lose.

The keys you need to press to bash the moles are T, Y, U, G, H, J, B, N and M. Although these are arranged in a three by three pattern on the keyboard, I felt when reading the instructions that it would be pretty difficult to remember which key attacked which mole. I need not have worried. Each 'mole hole' has the relevant letter underneath it, and it takes only a few frantic seconds before you get your fingers co-ordinated.

The game is fun to play, but it is far from easy to play well. This suggests it would prove quite addictive as you reyurned to it again and again to improve your mole-bashing skills.

Colour is used particularly effectively. ROAD RACE and CLOWNS are dull by comparison.

USE OF GRAPHICS: *******
ADDICTIVE QUALITY: *****
VALUE FOR MONEY: ******



GAME: Super Lander
PRICE: $37.95

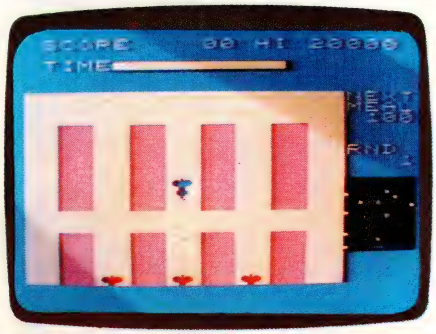
This is one of the first games I recall seeing for the VIC 20. Despite its age, the program has worn extremely well. In it, you have to land a space craft on the Luna surface using right and left thrust (the 'A' and 'D' keys) and upward thrust (function keys one, three and five).

There are three landing sites, with the number of points gained per landing based on the difficulty of the site. Based on my experience with this game; I do not think my chances of employment with the Luna arm of the Terran Empire Fleet are particularly good. Although I became quite an ace landing on the simplest site, the other two remained beyond my capabilities.

The program is, in my opinion, a success because it occurs in real time. Gravity and inertia are working against you all the time, and the craft responds to your controls in a realistic manner which is almost uncanny. Even the slightly blurry picture when the screen magnifies the particular site you've moved up close to looks like a television picture as one would expect in the circumstances in 'real life'.

This is not a game for those who like the ongoing thrill of a Pac-Man game, or the relentless threat of death from galactic intruders. However, it wins a good rating in this review because of the realistic way the simple game idea has been implemented. If you are a patient player, and like having your skills tested, you may well find this game a challenge which will keep you absorbed for many hours.

USE OF GRAPHICS: *****
ADDICTIVE QUALITY: ******
VALUE FOR MONEY: ******



GAME: Rat Race
PRICE: $37.95

In this game you are a mouse caught in a maze, and your objective is to eat all of 10 cheeses which are dotted around the maze before you are caught by a running rat, run into a black cat, or your time runs out. You have only three lives in all.

The first cheese is worth 100 points, the second is 200 and so on. As well, there is a 'bonus cheese' which works like a doubling cube in Backgammon. Eat this cheese, and all cheeses from then on in that round of the game are worth twice the points they would have been otherwise.

On the right hand side of the screen is a small-scale plan of the maze, which not only shows you where each cheese is, but also where each rat is. However, I found the game frantic enough without having time to spare to look at the 'radar map' on the side for additional clues.

Your 'secret weapon' is the S key, which leaves a trail of scent (shown as white stars) which confuses a rat which is chasing you.

The game is not as difficult to master

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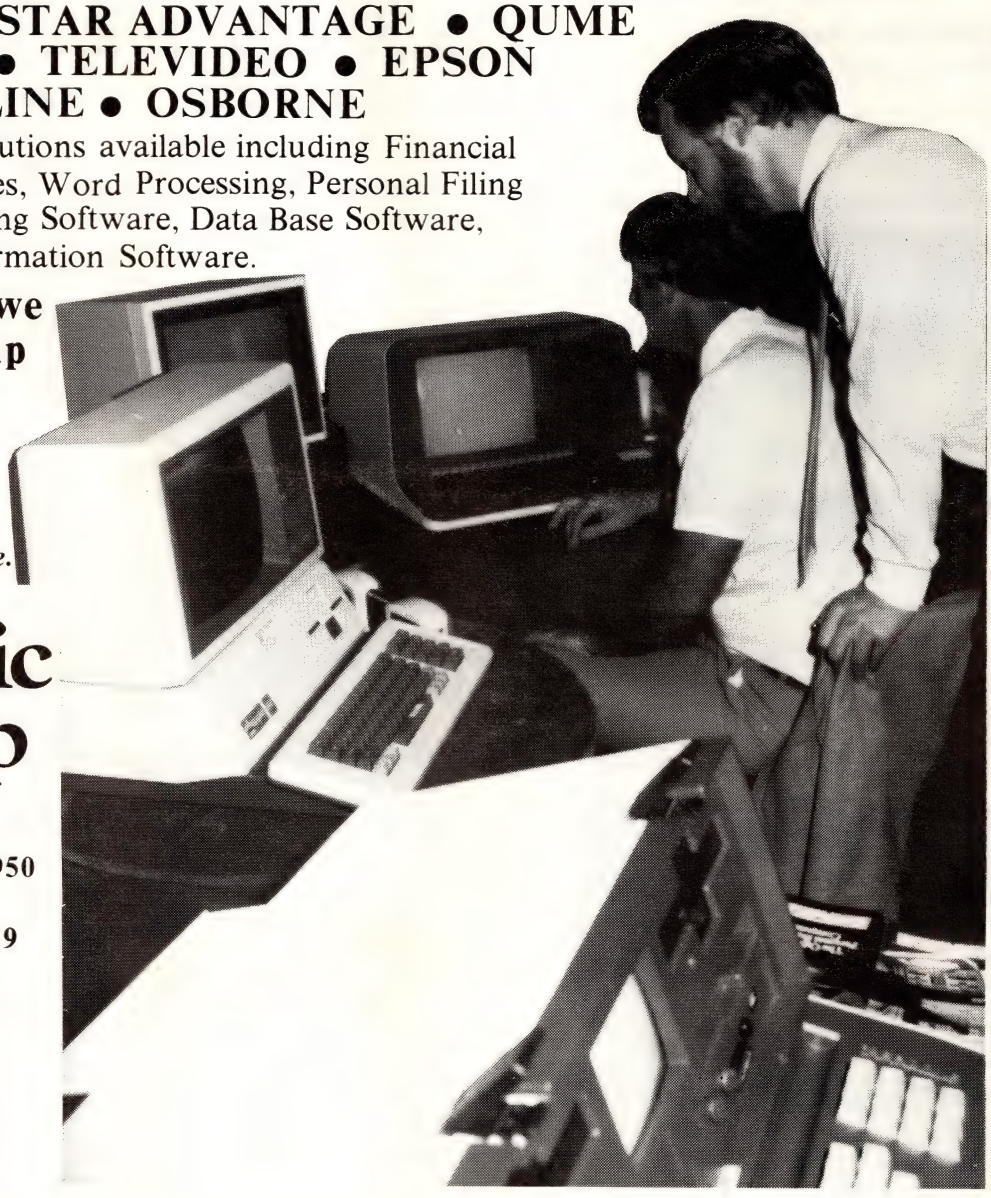

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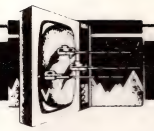

as the above description may sound. The maze is much bigger than a single screen, so the screen acts as a window on the whole maze, with the viewpoint moving as you move. I always think this is a particularly effective technique, and it is well implemented here.

The game can be played with the keyboard, or with a joystick. It is much easier (and much more fun) to play with a joystick. My objection to this game is that it is really too easy. The rats which are meant to be chasing you are few in number, fairly lethargic, and always (without fail) defeated by a simple shot of the S button. You cannot run into walls because if you reach a wall you automatically turn so it is possible to just let yourself run without control around the edge of the maze waiting till you see a cheese, and then double back and get it. If a rat comes near you, you just press the 'S' key (or hit the fire button) and the rat gets confused.

In conclusion, a good idea, but not well implemented.

USE OF GRAPHICS: *****
ADDICTIVE Quality: **
VALUE FOR MONEY: ***

GAME: Avenger
PRICE: $37.95

This is the Commodore implementation of Space Invaders, and a very good implementation it is, too. This is my favourite of the cartridges reviewed, as it includes the arcade features of a mothership for bonus points, arcade-like sound (including the relentless thump-thump-thump heart beat sound as the invaders get closer to you) and represents a series of difficult challenges.

There is a high score feature, and the entire screen goes red when you get hit by an invader. If you do not have a joystick, you use the 'L' key to move left, the ';' to move right, and the 'A' to fire your laser. There are three standard invaders, worth 10, 20 and 30 points respectively, with a 'mystery score' for hitting the mothership. You get a bonmus life if your score tops 1500.

Although Space Invader experts may find the game relatively easy to defeat, I found it impossible, and could not even wipe out half the invaders before one of them had reached the ground, or I had lost all my lives.

The game is far more satisfying to play using a joystick, rather than the keyboard. However, the program responded most sluggishly to the fire button, which meant I felt I was fighting the equipment almost as much as I was fighting the aliens.

Like all the cartridges reviewed in this article, the display needs to be centred. There is no option in this game to move the display up or down the screen. This is most unfortunate, as I found the picture was about a fifth of the screen height too high, meaning I had a blank area wasted at the bottom of the screen and could barely see the score and highscore at the top.

Despite this, Avenger ranks with Moles as the best of the cartridges I reviewed, and seems to me to be almost a must purchase.

USE OF GRAPHICS: *******
ADDICTIVE QUALITY: *******
VALUE FOR MONEY: *******

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J J Clessa

Quickie

A certain family has three children – half of the children are boys. How is this?

Prize Puzzle

Four ladies went into a post office to buy stamps.

Alice bought only 3c *(please ignore, for the purposes of the puzzle that there isn't any such thing as a 3, 4, 6 or 8 cent stamp.)* stamps. Betty bought only 4c stamps. Celia bought only 6c stamps and Doris bought only 8c stamps.

The total money spent by the ladies was $1.61.

The daughter got the fewest number of stamps and spent 24c.

The mother got the most stamps – she spent 72c.

Which of the four women were mother and daughter?

February Prize Puzzle

A low response – only 12 entries in all – denoting a more than average degree of difficulty.

There were several possible solutions to most of the ten parts of the problem, but we are only printing the answers submitted by the winning entrant who is Mr. B. Joyce of Epping.

The winning solution was:

1000000007
1111111121
3222222229
3333133333
4444444447
5555555557
6666666661
7777717777
8888880881
9199999999

Congratulations, Mr. Joyce, your prize should be with you by the time you read this.

THE NEC/APC $2500 MANHUNT

The hunt is over and our man has been found. Congratulations to P Butterworth from Crows Nest who was the first person to ring in with the correct solution.

And for all of you who want to know, here are the correct answers:–

Puzzle 1 (January): 66266 and 8
Puzzle 2 (February): 358926471 and 2
Puzzle 3 (March): 44744 and 7
N (Nineteen digit number):
6626635892647144744
N3:2909908448699031128849518850594873447742910872076673827 84

The three single digit answers appear in N^3 where underlined. Reading to the left from that place, the next 35 digits form the key to the cipher. Decipher by writing the alphabet, space and the digits 0 to 9 in a circle. Each digit of the key is an anticlockwise displacement of the cipher digit. This gives the plain text:–

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Easy, wasn't it?

Numerous readers have written in to inquire why 42924 is not the answer to question number 3, rather than our larger answer of 44744.

You were given a strong hint in question 4. The question asked for a triangle in which 'only one of these digits appears in any of the sides'.

The required interpretation is that the digit which appears in one or more of the sides be unique. Given the palindromic nature of the perimeter this means that it has to be the middle digit, the only unique one. This is the case with 44744, but with 42924 it is the 4, which is not unique, which appears in a side (albeit only once!). In answer to many queries, the sides of the 44744 triangle are 12376, 13818 and 18550.

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Print speed — 50 characters (left to right, unidirectional)
Max. number of columns — 80 columns
Character spacing — 10 characters/inch
Linefeed spacing — 6 lines/inch — Character mode, 9 lines/inch — Graphic mode
Linefeed speed — 5 linefeed/sec — Character mode, 7.5 linefeeds/sec — Graphic mode
Paper feed — Pin feed
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Interface — Centronics standardized parallel interface (TTL level) built in printer
Matrix — Character mode: 9 x 7 matrix, Graphic mode: 6 x 6 matrix
Printing direction — Character mode: Bi-directional printing with logical seeking function. Graphic mode: Uni-directional printing from left to right
Number of characters per line — 80/96/131 (40/48/66 for double-width characters)
Printing speed — 80 characters/sec
Character set — JIS 160 codes/ASCII 96 codes + International character codes 64 graphics patternms
Character size — 2.0 (W) x 2.6 (H) in mm in case of 80 columns/line
Character space — 2.54mm (1/10 inch) in case of 80 columns/line
Line space — 1/6, 1/8 or 1/12 inch
Paper feed system — Friction type: Friction feed, Tractor type: Variable sprocket feed or friction feed
Line feed speed — 7.5 lines/sec at 1/8 spacing, 10 lines/sec at 1/8 inch spacing
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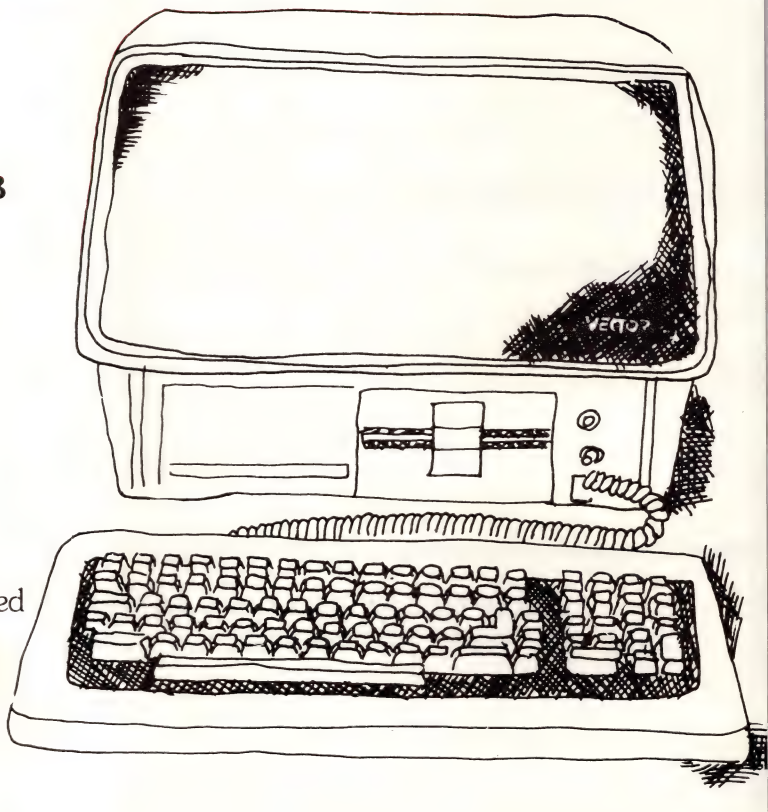

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PROGRAMS

APC is interested in programs written in Basic, Pascal, Forth, Logo and Comal – all of which being languages we've covered in previous issues. Please supply your programs on disk or cassette with all necessary documentation (so we've got a good idea what it's about and how much memory it uses) and, if you can, a clear listing on plain white paper.

As all programs in APC are checked either by a referee or by one of the editorial staff, it can take some time for a program to actually appear. If you don't hear from us within two months or so, it usually means your contribution is in the referee pipeline. It's essential to ensure that your program is fully debugged before you send it in – get a friend to try it out first – and all programs we publish are paid for at a regular rate. Send contributions to: APC Programs, P.O. Box 280, Hawthorn, Vic 3122 – and please enclose an SAE if you want material returned.

Bricklayer

by R Agius

The program occupies 7.4k (while running) on a CBM 4032 and can be pruned by removing the REM statements and instructions to run on a CBM 3008. Instructions are included in the listing.

One variation is possible: swapping the '.102' in lines 900 to 970 to '.32' will cause the opponent to no longer make walls.

```
10 CLR
20 LU=20:IFPEEK(65E3)<>254THENLU=100
30 REM*BRICKLAYER BY R.AGIUS OCT '82
40 DIMT(20),HS(20),HS$(20)
50 REM*TEASING SOUND TAKEN FROM JUGGLE PROGRAM PRINTED IN APC '82
60 GOSUB1680
70 DATA110,130,98,110,130
80 RESTORE
90 FORWE=1TO5:READN(WE):NEXT
100 DATA2,1.2,.5,2,5
110 FORWE=1TO5:READL(WE):NEXT
120 REM
130 POKE59467,15:POKE59466,15:POKE59464,0
140 SN=59464
150 F=0
160 SC=0
170 PRINT"▒▒";
180 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒";
190 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
200 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
210 TV=0
220 FU=500:REM**FUEL
230 C=0:REM**BASES
240 F=F+1:REM**FRAME COUNT
250 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
260 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
270 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
280 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
290 B=0:REM**MOVEMENT
300 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
310 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
320 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
330 PRINT"▒::::::  ▒ ■ ::::::::::::::::: ▒ ■ ::::::▒";
340 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
350 IFPO>20THENPO=20
360 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
370 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
380 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
390 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
400 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
410 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
420 PRINT"▒::::::::::::::::::::::::::::::::::::::▒";
430 TI$="000000":REM**TIME ELAPSED
440 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒";
450 IFG=1THENPRINT"SQQQQQQQQQQQQQQQQQQQQQQQQHIGHEST SCORE :"HS(PO)
460 PRINT"SQ■■■■■■■"F
470 PRINT"SSCORE :              TIME TAKEN"
```

PROGRAMS

```
480 PRINT"SQQQQQQQQQQQQQQQQQQQQQQFUEL  :"
490 FORO=1TOPO-1+F
500 T(O)=INT(RND(0)*720 +1)+32889
510 IFPEEK(T(O))=102ORPEEK(T(O))=160THENGOTO500
520 NEXT
530 X=32768+620
540 D=PEEK(151)
550 GETD$:IFD$="!"THEN50
560 IFFU<0THENWL=0:GOTO1530
570 PRINT"SQQQQQQQQQQQQQQQQQQQQQQ]]]]]]]]";INT(FU)"]    "
580 IFLW=1ANDWL=1THENIFPEEK(151)=34THENFU=FU-1:GOTO710
590 PRINT"S]]]]]]]]"SC
600 PRINT"]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]";INT(TI/60)
610 IFC>=2THEN1990
620 IFTV=1THENPOKEWX,152:GOTO 1550
630 IFD=50ANDPEEK(X-40)<>102THENPOKEX,32:B=-40:GOTO850
640 IFD=58ANDPEEK(X-41)<>102THENPOKEX,32:B=-41:GOTO850
650 IFD=57ANDPEEK(X-39)<>102THENPOKEX,32:B=-39:GOTO850
660 IFD=25ANDPEEK(X+41)<>102THENPOKEX,32:B=+41:GOTO850
670 IFD=26ANDPEEK(X+39)<>102THENPOKEX,32:B=+39:GOTO850
680 IFD=18ANDPEEK(X+40)<>102THENPOKEX,32:B=40:GOTO850
690 IFD=41ANDPEEK(X+1)<>102THENPOKEX,32:B=1:GOTO850
700 IFD=42ANDPEEK(X-1)<>102THENPOKEX,32:B=-1:GOTO850
710 IFPEEK(X+B)=102THENB=0
720 POKEX,32
730 GOTO850
740 IFPEEK(X+B)=58THENSC=SC+10:POKESN,36:POKESN,0
750 R7=R7+1:IFR7/2=INT(R7/2)THEN770
760 IFPEEK(X+B)=255THENPOKEX+B,152:GOTO1550
770 IFPEEK(X+B)=127THENPOKEX+B,152:GOTO1550
780 IFPEEK(X+B)=102THENB=0
790 IFPEEK(X+B)=160THENGOTO 1340
800 X=X+B
810 POKEX,35
820 REM
830 FU=FU-.0625:REM**FUEL USAGE
840 RETURN
850 GOSUB740
860 V=INT((X-32768)/40):H=INT((((X-32768)/40)-V)*40):GOSUB880
870 GOTO540
880 REM
890 FORU=1TOPO-1+F:ER=0:GOSUB1070
900 IFT=40ANDPEEK(T(U)+40)<>102THENPOKET(U),102:GOTO990
910 IFT=-40ANDPEEK(T(U)-40)<>102THENPOKET(U),102:GOTO990
920 IFT=-41ANDPEEK(T(U)-41)<>102THENPOKET(U),102:GOTO990
930 IFT=+41ANDPEEK(T(U)+41)<>102THENPOKET(U),102:GOTO990
940 IFT=-39ANDPEEK(T(U)-39)<>102THENPOKET(U),102:GOTO990
950 IFT=+39ANDPEEK(T(U)+39)<>102THENPOKET(U),102:GOTO990
960 IFT=1ANDPEEK(T(U)+1)<>102THENPOKET(U),102:GOTO990
970 IFT=-1ANDPEEK(T(U)-1)<>102THENPOKET(U),102:GOTO990
980 T=0
990 IFPEEK(T(U)+T)=35THENPOKET(U)+T,152:WX=T(U)+T:TV=1
1000 IFLW=1ANDPEEK(151)=34THENFU=FU-1: POKEX,32:GOSUB740
1010 POKESN,255:POKESN,0
1020 IFPEEK(T(U)+T)=160THENC=C+1
1030 IFR7/2=INT(R7/2)THEN1050
1040 POKET(U)+T,127:T(U)=T(U)+T:GOTO1060
1050 POKET(U)+T,255:T(U)=T(U)+T
1060 NEXT:RETURN
1070 IFRND(1)>1THENGOSUB 1230:RETURN:REM*HOW SMART WILL OPPONENT BE ?
1080 V1=INT((T(U)-32768)/40):H1=INT((((T(U)-32768)/40)- V1)*40)
1090 TY=T
1100 D1=SGN(V-V1):REM**MAKE  .  .  . SMART
1110 D2=SGN(H-H1):REM " "  "       " " "
1120 IFD1=-1ANDD2=-1THENT=-41  :GOTO1220
1130 IFD1=1ANDD2=1THENT=+41:GOTO1220
1140 IFD1=-1ANDD2=1 THENT=-39 :GOTO1220
1150 IFD1=1ANDD2=-1THENT=+39:GOTO1220
1160 IFD2=-1THENT=-1:GOTO1220
1170 IFD1=1THENT=40:GOTO1220
1180 IFD1=-1THENT=-40:GOTO1220
1190 IFD2=1THENT=1:GOTO1220
1200 IFD1=0THENT=-40:GOTO1220
1210 IFD2=0THENT=-1:GOTO1220
1220 IFPEEK(T(U)+T)<>102THENRETURN
1230 H=INT(RND(0)*8)+1
1240 IFH=1THENT=-41
1250 IFH=2THENT=40
1260 IFH=4THENT=41
1270 IFH=4THENT=41
1280 IFH=5THENT=1
1290 IFH=6THENT=-1
1300 IFH=7THENT=39
1310 IFH=8THENT=-39
1320 IFH<1ORH>8THENT=-1
1330 RETURN
1340 FORP=32849TO33607:W=PEEK(P):IFW=58THENQX=1:P=33607:REM**TEST FOR DOTS
1350 NEXTP
1360 IFQX=1THEN1400
1370 PRINT"SQQQQQQQQQQQQQQQQQQQQQQ]]]]]]]]]]]]]]]]YOU WIN"
1380 FORWE=1TO6:POKESN,N(WE):FORQW=1TO 50:NEXT:NEXT:   POKE59464,0
1390 FORY=1TO500:NEXT:GOTO170
1400 PRINT"SQQQQQQQQQQQQQQQQQQQQQQ]]]]]]]]]]]]]]]]YOU CHEATED";
1410 QX=0
1420 POKESN,235:FORWE=1TO100:NEXT:POKESN,0
```

PROGRAMS

```
1430 FORQ=1TO500:NEXT: PRINT"                "
1440 C=C+1:IFC>=2THENGOTO1460
1450 GOTO800
1460 PRINT"CHEATED TOO OFTEN YOU LOSE"
1470 IFSC>=HS(PO)THENHS(PO)=SC:GOSUB2130
1480 FORWE=1TO1000:NEXT:GOSUB1650
1490 GETA$
1500 IFA$="Y"THEN50
1510 IFA$=CHR$(13)THEN120
1520 GOTO1490
1530 PRINT"OUT OF FUEL YOU LOSE"
1540 GOTO1580
1550 PRINT"EATEN YOU LOSE"
1560 FORWE=1TO6:POKESN,N(WE):FORQW=1TO220*L(WE):NEXT:NEXT
1570 POKESN,0
1580 G=1:IFSC>=HS(PO)THENHS(PO)=SC:GOSUB2130
1590 GOSUB1650
1600 GETA$
1610 IFA$="Y"THEN50
1620 IFA$=CHR$(13)ANDQ$="Y"THENYT=0:GOTO50
1630 IFA$=CHR$(13)THEN120
1640 GOTO1600
1650 PRINT"                              GAME OVER"
1660 G=1
1670 RETURN
1680 PRINT" RICHARD AGIUS' BRICKLAYER "
1690 PRINT"   DEVISED BY R.AGIUS OCT '82"
1700 PRINT:PRINT "  THE  OBJECT OF THIS GAME IS TO EAT AS "
1710 PRINT"MANY DOTS AS YOU CAN.          "
1720 PRINT" CONTROL IT BY USING NUMBER PAD '5'
1730 PRINT"BEING THE CENTRE POINT"
1740 PRINT"  ONCE ALL DOTS HAVE BEEN EATEN RETREAT"
1750 PRINT"TO GREEN BLOCKS TO ENTER A NEW FRAME"
1760 PRINT"IF TRY TO CHEAT FIRST CHANCE IS GONE"
1770 PRINT"BEWARE OF OPPONENTS DESTROYING ESCAPE."
1780 PRINT"BEWARE OF WALLS BUILT BY OPPONENTS AS,"
1790 PRINT"THEY CAN TRAP THEMSELVES OR YOUR DOTS"
1800 PRINT"EACH FRAME EXTRA OPPONENT"
1810 PRINT"AFTER GAME PRESS 'Y' TO RECHOOSE OPPON."
1820 PRINT"AT END OF GAME PRESS RETURN FOR A GAME"
1830 PRINT"BEWARE OF FUEL"
1840 PRINT"  THE MORE  OPPONENTS THE SLOWER THE     GAME . ";
1850 PRINT"PUSH '' TO QUIT"
1860 PRINT"HOW MANY OPPONENTS DO YOU WANT( <"LU")  TO START WITH ";
1870 INPUTPO
1880 IFPO<=0ORPO>20THENPO=1
1890 PRINT"DO  YOU  WANT TO MOVE FASTER THAN THEY  (Y/N/SCORES    )"
1900 GETE$:IFE$="Y"THENLW=1:GOTO1940
1910 IFE$="S"THENGOTO2010
1920 IFE$="N"THEN1950
1930 IFE$<>"N"THEN1900
1940 PRINT"THE '5' KEY SPEEDS YOU UP"
1950 PRINT"  PRESS  RETURN TO BEGIN"
1960 GETE$:IFE$=CHR$(13)THENRETURN
1970 GOTO1960
1980 END
1990 PRINT"DOLLAR ATE YOUR ESCAPE    "
2000 GOTO1470
2010 PRINT"HIGHEST SCORES FOR THE DAY"
2020 PRINT:PRINT
2030 PRINT"OPPONENTS          "
2040 PRINT"AT START    HIGH SCORE"
2050 PRINT:PRINT
2060 FORXC=1TO10
2070 PRINTXC,HS(XC),HS$(XC)
2080 NEXT
2090 PRINT:PRINT
2100 PRINT"PUSH SPACE   TO CONTINUE"
2110 GETR$:IFR$<>" "THENE$="Y":GOTO1890
2120 GOTO2110
2130 PRINT" CONGRADULATIONS  YOU GOT HIGHEST SCORE "
2140 PRINT:PRINT:PRINT"WRITE YOUR NAME"
2150 POKE158,0
2160 INPUTHS$(PO)
2170 PRINT:PRINT:PRINT"PRESS ANY KEY TO CONTINUE"
2180 GETR$:IFR$=""THEN2180
2190 RETURN
READY.
```

Escape Maze

by G Roberts

Here's a contribution from across the Tasman. It's written for the Atari 400 or 800 with 16k of RAM and a joystick. The object of the game is to escape from three mazes. Details of the code are given below:

Lines 1 — 8: Introduction. Add the following lines if you want SYSTEM RESET to restart the game.

0 POKE 2,0:POKE 3,6 9,2:POKE 1536,76:POKE 1537,64:POKE 1538, 185:TRAP 17000

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PROGRAMS

17000 RUN

Lines 9 — 65: Command for first maze. Gosub 2000 reads Data lines (12-18) to draw maze. Gosub 9000 (-9090) gives joystick commands which control the moving pixel. These commands are same for mazes 2 & 3 also. Line 9000 specifically gives time limit for all 3 mazes. Line 62 tests x,y co-ordinates for the invisible walls which if positive sends pixel back to start. Line 63 tests to see if pixel is at door of first maze. Line 64 with Gosub 7000 tests for pixel hitting wall (if positive Gosubs 1000-1010): Gosub 16000 records number of wall hits. Line 65 draws pixel with color 1 while followed by color 3 so as not to leave a trail.

Lines 3000 — 4020: Graphics & sound commands for escaping first maze.

Lines 4090 — 5180: Commands for second maze. Line 5157 is a test for sending pixel through to the third maze. Line 5159 with Gosub 14000 tests for pixel hitting wall. If positive Gosub 13000-13010 gives the graphics and sound routine. If negative lines 14020-14030 randomly draw a wall (14030) in maze at a low probability rate (14020). Gosub 15000 randomly places pixel somewhere else in maze as a result of being blasted and thrown from wall.

Lines 5190 — 6090: Commands for third maze. Line 6075 tests to see if pixel is at door of third maze. If positive lines 8000 to 8070 give graphics and sound commands for conclusion and replay option. Line 6080 with Gosub 7050 tests for pixel hitting wall. If positive sends player back to start of first maze.

```
        ** ESCAPE MAZE **

1 GRAPHICS 0:POKE 752,1:SETCOLOR 2,6,1:P
OSITION 0,10:? ,"     ESCAPE MAZE":POSITI
ON 0,12:? ,"   G.C. ROBERTS"
2 POSITION 0,14:? ,"        1982"
3 FOR I=1 TO 255 STEP 4:SOUND 0,I,8,10:G
OSUB 11000:NEXT I
5 FOR T=1 TO 10:SETCOLOR 2,6,1:FOR D=1 T
O 50:NEXT D:SETCOLOR 2,6,7:FOR D=1 TO 50
:NEXT D:NEXT T:SOUND 0,0,0,0
6 GRAPHICS 0:POKE 752,1:SETCOLOR 2,4,6:S
ETCOLOR 1,0,0:RESTORE
7 TIME=0:FOR T=1 TO 23:? "EASY! NOT AS E
ASY AS IT LOOKS!"
8 FOR R=1 TO 5:SOUND 0,INT(RND(1)*256),1
0,10:NEXT R:NEXT T:SOUND 0,0,0,0
9 REM *   <<< MAZE 1 >>>
10 GRAPHICS 7+16:COLOR 2:GOSUB 2000
12 DATA 0,0,159,0,159,0,159,95,159,95,0,
95,0,95,0,50,0,40,0,0
13 DATA 10,10,30,10,40,10,80,10,90,10,15
0,10,2,20,10,20,50,20,90,20,100,20,150,2
0,30,30,40,30,60,30,70,30
14 DATA 80,30,90,30,120,30,150,30,40,40,
50,40,70,40,100,40,110,40,150,40,30,50,5
0,50,90,50,100,50,110,50,150,50
15 DATA 40,60,60,60,70,60,80,60,100,60,1
50,60,4,70,30,70,54,70,90,70,100,70,150,
70,20,80,40,80,60,80,76,80
16 DATA 90,80,150,80,24,90,50,90,70,90,8
0,90,10,20,10,80,20,10,20,60,20,80,20,90
,30,20,30,40,30,50,30,60
17 DATA 40,10,40,30,40,60,40,80,50,20,50
,50,50,64,50,94,60,30,60,70,60,80,60,95,
70,2,70,10,70,40,70,50
18 DATA 80,30,80,60,80,70,80,90,90,10,90
,30,90,50,90,70,90,74,90,95,100,30,100,4
0,110,30,110,40,999,999
27 X=156:Y=48
28 COLOR 1:SETCOLOR 2,0,0
29 GOSUB 9000
```

```
62 IF MAZE=1 THEN IF X<60 AND Y<40 THEN
GOTO 27
63 IF X<1 AND Y<50 THEN GOTO 3000
64 GOSUB 7000
65 COLOR 1:SOUND 0,0,0,0:PLOT X,Y:COLOR
3:PLOT J,K:GOTO 28
1000 GOSUB 16000
1010 SOUND 0,64,10,8:GOTO 27
2000 READ X,Y:IF X<>999 THEN PLOT X,Y:RE
AD X,Y:DRAWTO X,Y:GOTO 2000
2010 RETURN
3000 X=1:Y=45:FOR T=1 TO 3:FOR C=1 TO 14
:SOUND 0,64,C,C:SETCOLOR 1,C,C:FOR D=1 T
O 35:NEXT D:NEXT C
3005 FOR W=1 TO 20:NEXT W:NEXT T
3010 FOR C=0 TO 15 STEP 3:FOR D=1 TO 10:
NEXT D:SETCOLOR 4,C,7
3020 FOR P=243 TO 31 STEP -7:FOR D=1 TO
5:NEXT D:SOUND 0,P,10,9:NEXT P:NEXT C
3900 GRAPHICS 0:POKE 752,1:SETCOLOR 2,6,
4
4000 POSITION 0,10:PRINT ,,"CONGRATULATI
ONS!"
4005 PRINT ,"YOU FOUND A WAY AROUND THE
 INVISIBLE WALLS!"
4020 SOUND 0,0,0,0:FOR T=1 TO 900:NEXT T
:RESTORE 5000
4090 REM %   <<< MAZE 2 >>>
5000 HIT=0:MAZE=0:TIME=0:GRAPHICS 7+16:S
ETCOLOR 1,8,10:COLOR 2:GOSUB 2000
5100 DATA 0,0,159,0,159,0,159,95,159,95,
0,95,0,95,0,50,0,40,0,0,20,10,50,10,60,1
0,150,10,1,20,30,20,40,20,66,20
5105 DATA 80,20,140,20,20,10,20,20,30,0,
30,10,10,30,30,30,90,30,100,30,44,80,50,
80
5110 DATA 30,30,60,30,110,30,140,30,10,4
0,50,40,110,40,150,40,20,50,56,50,80,50,
90,50,110,50,150,50,0,60,20,60
5120 DATA 24,60,60,60,100,60,140,60,20,7
0,40,70,50,70,76,70,80,70,140,70,10,80,4
0,80,60,80,150,80
5130 DATA 10,40,10,56,20,50,20,95,30,20,
30,30,50,30,50,40,50,64,50,95,60,10,60,6
0,70,20,70,70,80,20,80,50
5140 DATA 80,60,80,70,90,34,90,66,100,30
,100,60,110,30,110,40,140,20,140,30,140,
60,140,70,150,10,150,40
5150 DATA 40,14,40,20,60,84,60,95,70,0,7
0,10,110,50,110,56,150,50,150,80,999,999
5155 X=156:Y=48
5156 COLOR 1:SETCOLOR 2,0,0
5157 IF X<50 AND Y<50 THEN GOTO 6000
5158 GOSUB 9000
5159 GOSUB 14000
5180 COLOR 1:SOUND 0,0,0,0:PLOT X,Y:COLO
R 3:PLOT J,K:GOTO 5156
5190 REM %   <<< MAZE 3 >>>
6000 TIME=0:GRAPHICS 7+16:SETCOLOR 1,4,1
0:COLOR 2:GOSUB 2000
6005 DATA 0,0,159,0,159,0,159,95,159,95,
```

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.....

SUBURB: ..... P/CODE: .....

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Membership Fee $55.00/$30.00

☐ Pay by Bankcard/
Bankcard No: _____

Expiry Date: _____

☐ Pay by Cheque/Money Order

Cartridge Title required: _____
(VIC-20 only at this stage)

Alternative _____

Signature:(Member and Card Holder) .....

RECEIPT & RULES

CONDITIONS OF MEMBERSHIP:

(1) Membership fee of $55.00 (incl. first Commodore cartridge) Non-cartridge member $30.00, both renewable annually. $10.
(2) Reduced membership rates are available with additional cartridges purchased at the time of making membership application.
(3) Exchange of Cartridges allowed at the rate of $7.00 at time of exchange. (+ $1 certified postage if applicable).
(4) The variety and number of cartridges available for exchange will be controlled by The VIC Centre.
(5) All Cartridges returned for exchange must be working and undamaged.
(5A) A service charge will be incurred on all repairable cartridges.
(6) Packaging and instructional material must be returned with the cartridge and in good condition.
(7) The cartridge returned must be the same cartridge borrowed.
(8) MAXIMUM time exchange is 1 calendar month, after this time the cartridge is unreturnable and deemed the property of the member.

Date: / /1983.

SIGNATURES:(Client) .....

(The VIC Centre) .....

NOTE: The signing of this form indicates agreement to the rules of membership.

```
0,95,0,95,0,60,0,50,0,0
6010 DATA 10,10,50,10,60,10,90,10,100,10
,140,10,10,20,60,20,80,20,130,20,140,20,
150,20,20,30,86,30,90,30,110,30
6020 DATA 130,30,140,30,1,40,20,40,50,40
,140,40,20,50,30,50,54,50,130,50,10,60,2
0,60,50,60,96,60,100,60,110,60
6030 DATA 54,70,90,70,120,70,136,70,20,8
0,30,80,40,80,60,80,70,80,140,80,10,90,2
0,90,34,90,66,90,70,90,150,90
6040 DATA 10,10,10,30,10,50,10,86,20,40,
20,60,20,64,20,90,30,34,30,76,30,80,30,9
5,40,30,40,80,50,20,50,30
6050 DATA 50,40,50,76,50,80,50,90,60,1,6
0,10,70,14,70,30,70,64,70,95,80,10,80,20
,90,30,90,40,10,30,10,40
6060 DATA 100,14,100,30,100,44,100,70,11
0,80,110,80,120,20,120,36,120,60,120,70,
140,10,140,30,140,40,140,70
6070 DATA 130,50,130,60,150,20,150,50,15
0,60,150,90,999,999
6072 X=156:Y=55
6074 COLOR 1:SETCOLOR 2,0,0
6075 IF X<3 AND Y<59 THEN GOTO 8000
6076 GOSUB 9000
6080 GOSUB 7050
6090 COLOR 1:SOUND 0,0,0,0:PLOT X,Y:COLO
R 3:PLOT J,K:GOTO 6074
7000 LOCATE X,Y,A:IF A=2 THEN GOTO 1000
7010 RETURN
7050 LOCATE X,Y,A:IF A=2 THEN RESTORE :G
OTO 6
7055 RETURN
8000 X=1:Y=55:FOR S=1 TO 2:FOR I=255 TO
1 STEP -4:SOUND 0,I,10,10
8005 GOSUB 10000:NEXT I
8010 SETCOLOR 2,INT(RND(1)%16),0:NEXT S:
FOR I=255 TO 1 STEP -4:SOUND 0,I,8,10:GO
SUB 11000:NEXT I
8015 WAIT=10:FOR T=1 TO 20:SOUND 0,INT(R
ND(1)%256),10,10:GOSUB 12000:NEXT T:SOUN
D 0,0,0,0
8020 WAIT=3:FOR I=1 TO 255 STEP 4:SOUND
0,I,8,10:GOSUB 12000:NEXT I
8025 SOUND 0,0,0,0
8027 GRAPHICS 2:SETCOLOR 4,4,6
8028 POKE 709,12
8029 POKE 710,0
8030 ? "PRESS THE TRIGGER TO PLAY AGAIN
"
8040 FOR Y=1 TO 500:IF STRIG(0)=0 THEN R
ESTORE :GOTO 6
8050 NEXT Y:GRAPHICS 0:POKE 752,1
8060 POKE 709,12:POKE 710,0:POSITION 0,1
2:? ,"        THE END"
8070 GOTO 8070
9000 TIME=TIME+1:IF TIME=600 THEN GOTO 6
9010 J=X:K=Y:IF STICK(0)=14 THEN Y=Y-1
9020 IF STICK(0)=6 THEN X=X+1:Y=Y-1
9030 IF STICK(0)=13 THEN Y=Y+1
9040 IF STICK(0)=5 THEN Y=Y+1:X=X+1
```

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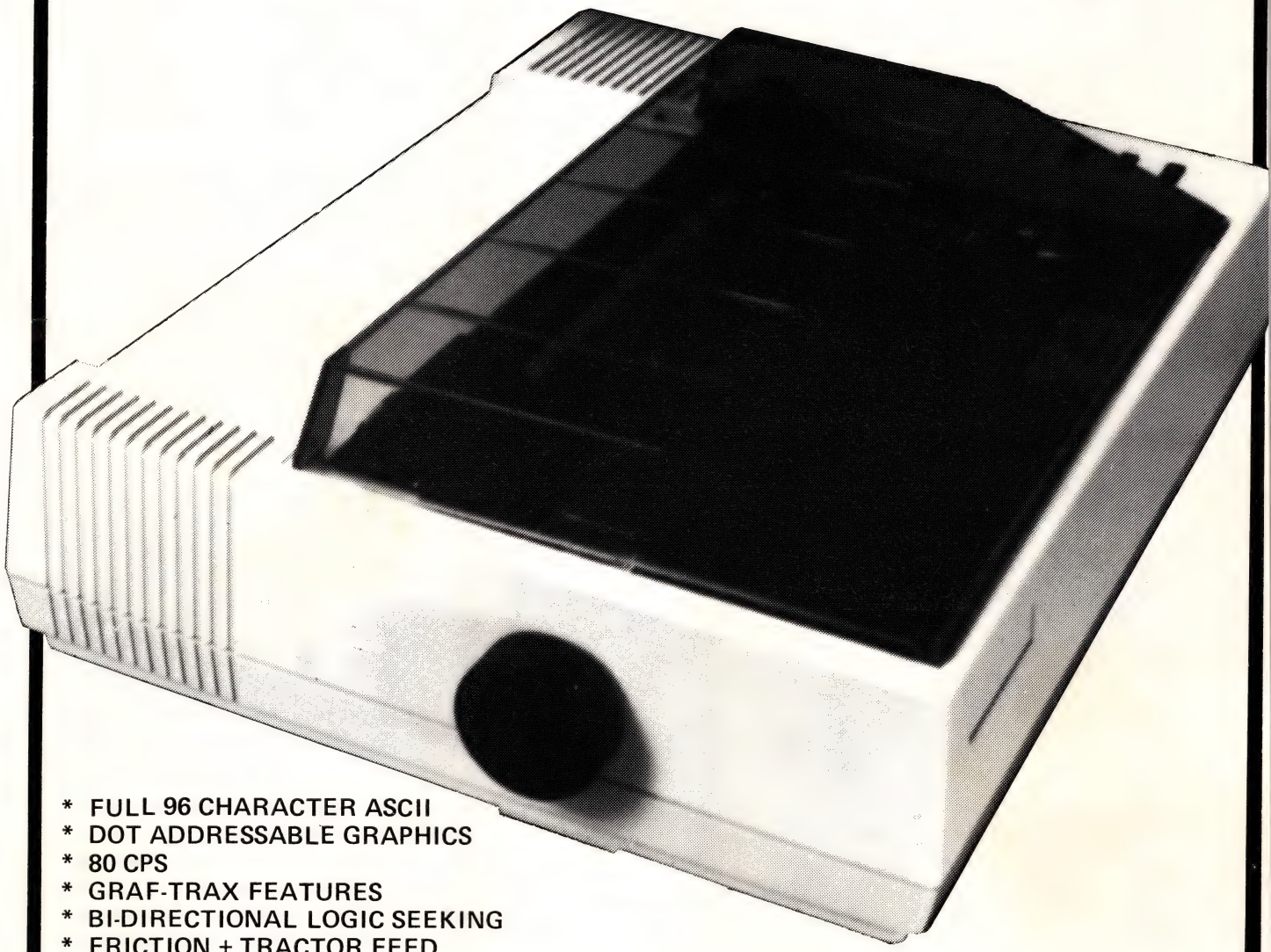

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PROGRAMS

```
9050 IF STICK(0)=9 THEN Y=Y+1:X=X-1
9060 IF STICK(0)=11 THEN X=X-1
9070 IF STICK(0)=10 THEN Y=Y-1:X=X-1
9080 IF STICK(0)=7 THEN X=X+1
9090 RETURN
10000 FOR W=1 TO 5:NEXT W:RETURN
11000 FOR W=1 TO 5:NEXT W:RETURN
12000 FOR W=1 TO WAIT:NEXT W:RETURN
13000 GOSUB 15000
13005 FOR I=1 TO 255 STEP 20:SOUND 0,I,8
,10
13010 FOR T=1 TO 15:POKE 710,32+T:NEXT T
:NEXT I:SOUND 0,0,0,0
13012 GOSUB 16000
13015 RETURN
14000 LOCATE X,Y,A:IF A=2 THEN GOSUB 130
00
14020 IF RND(0)%200>2 THEN RETURN
14030 TX=X:TY=Y:COLOR 2:GOSUB 15000:PLOT
 X,Y:DRAWTO ABS(X-40),ABS(Y-20):X=TX:Y=T
Y:RETURN
15000 X=INT(RND(0)%159):Y=INT(RND(0)%95)
:RETURN
16000 HIT=HIT+1:IF HIT=4 THEN GOTO 6
16010 RETURN
```


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USER RAM	32K	2K	8K	3K	7K
KEYBOARD TYPE	T	T	M	T	T*
BASIC BUILT-IN	STD.	STD.	OPT.	STD.	STD.
COLOR GRAPHICS	YES	YES	YES	YES	YES
MOVING GRAPHICS	YES	YES	YES	NO	NO
MUSIC	YES	YES	YES	YES	BEEP
SPEECH SYNTHESIZER	OPT.	OPT.	NO	NO	NO
DISPLAY SIZE	40/24	40/24	40/24	23/22	32/24
ROM PACKS	OPT.	OPT.	OPT.	OPT.	NO
MAXIMUM MEMORY	67K	52K	48K	32K	48K
DISKS	OPT.	OPT.	OPT.	OPT.	?
RS-232-C (SERIAL)	OPT.	OPT.	OPT.	OPT.	NO
PRINTER (SERIAL)	OPT.	OPT.	OPT.	OPT.	?
PRINTER (SPECIAL)	OPT.	OPT.	NO	NO	OPT.
TYPE OF BASIC	ANSI	ANSI	ATARI	MS	MS
PASCAL	OPT.	OPT.	NO	NO	NO
CASSETTE PORT	STD.	STD.	SPEC.	SPEC.	STD.
FORTH	OPT.	NO	NO	NO	NO
JOYSTICK BUILT-IN	YES	NO	NO	NO	NO

8K* = DEPENDS ON GRAPHICS MODE
T* = NO REAL TYPEWRITER KEYBOARD
? = IN DEVELOPMENT
ANSI = AMERICAN NATIONAL STANDARDS INSTITUTE (HAS ENHANCED GRAPHICS DEVELOPED ALONG WITH THE LOGO LANGUAGE)
MS = MICROSOFT BASIC
OPT. = OPTIONAL
STD. = STANDARD
SPEC = REQUIRES SPECIAL CASSETTE FROM MANUFACTURER

CHIP CHAT

. . . And now the latest computer craze — skinfold callipers. We'll refrain from saying any more because we're too shocked, but in the wake of *Fat is a Feminist Issue* and anorexia nervosa, as well as Richard Simmons' spectacular callisthenics, comes a keep fit program, HELP. You'll stay flabby while your Apple II sheds kilos of lipomatous flesh and replaces it with rippling muscle . . .

. . . A certain micro editor recently made headlines in a Melbourne newspaper. In an *'Observer's'* article *bel*lowing "Expert slams computers", he is reported *bel*ittling the home micro: "most ordinary wage-earners have no need for a home computer". One might suspect an almighty unanimous *bel*ch of indigestion from the micro trade at this point — at least that's what the said editor suspected as he continued: "And I know the computer makers won't like me for saying so." But to avoid a forest of *bell*icose mail accusing us of *bel*ying the facts (and perhaps avoid a li*bel* suit) we should at least quote a further paragraph of the article and emphasize that we are *only* quoting from the *Observer:* "But, it's ridiculous to use them to work out your cheque account balance. You might as well use a pocket calculator. And many people keep recipes in them. I can't see the sense in that."

To the trade: *we'd* never say anything like that (sound of frantic nail-polishing, self applause, etc) . . .

There is a newly formed company in Melbourne called Australian Personal Computer (Corp) Pty Ltd (headed by Adam Gatt) which sounds awfully like a micro magazine called Australian Personal Computer which has been around for over three years. So the magazine is rightfully indignant that someone should start a company with a name that's almost the same as its own *(well, let's face it — it bloody-well is the same!)* Don't be confused. Adam Gatt's organisation has nothing to do with us nor we them.

Commodore's boss. Jack Tramiel, has "got religion" — not just for himself, but also on behalf of his Commodore employees.

At the Hanover Fair, he told an audience of international journalists that "supplying computers at a price which people can afford is a religion at Commodore," and then passed on to discuss his future.

Most people dismissed the word "religion" as a useful metaphor, no more.

However, a strange document has reached us — a document which shows clearly that Tramiel thinks of his corporation not so much as a group of executives and workers, but more a "family at prayer".

This document is titled *The Commodore Philosophy* and is signed by Jack himself. It starts off by explaining that "The Commodore Philosophy is like a religion".

There follow a few instructions on how to think.

"Business to us is not a sport. It's war!"

"We don't believe in nationalism. We believe in internationalism. Commodore is an international company."

"Our marketing strategy is clear. We produce for the masses, not the classes."

This is wonderful, as church services go, but after prayers, most worshippers like a good homily. So Jack provides the necessary sermon, as follows.

(It is entitled "Professionalism and mutual improvement.")

"A good professional needs to practise every day . . . not to have only one 'concert' a year.

"Don't just react. Think first!

"Treat every situation as if you were the one being affected by your action.

Delegating is important but involvement is more important.

"We all have to involve ourselves in the problems as well as the successes.

The bit that went down best here came after the sermon, however. It was entitled: "Financial Responsibility", and it read:

"Treat every penny as your own." Send it round, Jack, and we'll do it, we'll do it . . .

Finally, for those who are really 'in the know' (hard luck if you aren't), here's a naughty little puzzler for you. Who accompanied the Queen on a tour of Silicon Valley recently? Her Majesty, of course . . .

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